CUT YOUR FINISHING TIME IN HALF

A ROUTER WITH HAIRSPLITTING ACCURACY

MASTER AN AGE-OLD JOINERY TECHNIQUE

Woodsmith®

Woodsmith.com

Vol. 31 / No. 185

Woodsmith 30 YEARS 1979 - 2009

INSIDE:

Get Smoother, More Accurate Cuts from Your Circular Saw

Secrets to Routing Perfect Flutes

Sanding: It Starts with the Right Tools

HANDSOME OAK BOOKCASE

› Build One, Two, or Three - page 30

A Publication of August Home Publishing

looking inside

Table of Contents

from our readers
Tips & Techniques 4

all about
Choosing the Right Glass 8
The combination of wood and glass is hard to beat. Here's how to make it work.

tools of the trade
Rotary Tool Routing 10
We'll show you how to get an even bigger bang from this common and versatile shop tool.

jigs and fixtures
Foolproof Fluting 12
Take a look at a couple of jigs that take the guesswork out of routing perfectly spaced flutes.

techniques from our shop
Making Dentil Molding. 14
A little time at the table saw and a simple jig is all it takes to make this traditional molding.

tips from our shop
Shop Notebook 28

woodworking technique
Large Profile Bits 40
Learn how to use these large bits to make factory-quality moldings on the router table.

woodworking essentials
Hand Sanding 42
When completing a project, hand sanding is the key to a smooth surface that's ready for finish.

working with tools
Woodsmith GO ONLINE EXTRAS
Put Your Circular Saw to Work. 44
Turn your circular saw into a real shop workhorse with just a few easy upgrades.

finishing room
Top-Notch Spray Can Finishing 46
You don't need expensive equipment to apply a professional-looking sprayed finish.

details of craftsmanship
Pinned Mortise and Tenon. 48
Here's a simple technique that adds both strength and a traditional look to a project.

hardware and supplies
Sources 51

Candle Stands page 16

Keepsake Boxes page 20

projects

weekend project

Candle Stands 16

This eye-catching project gives you the chance to fill an idle weekend with a healthy dose of straightforward woodworking. You'll have the candle stands up and glowing in short order.

designer series project

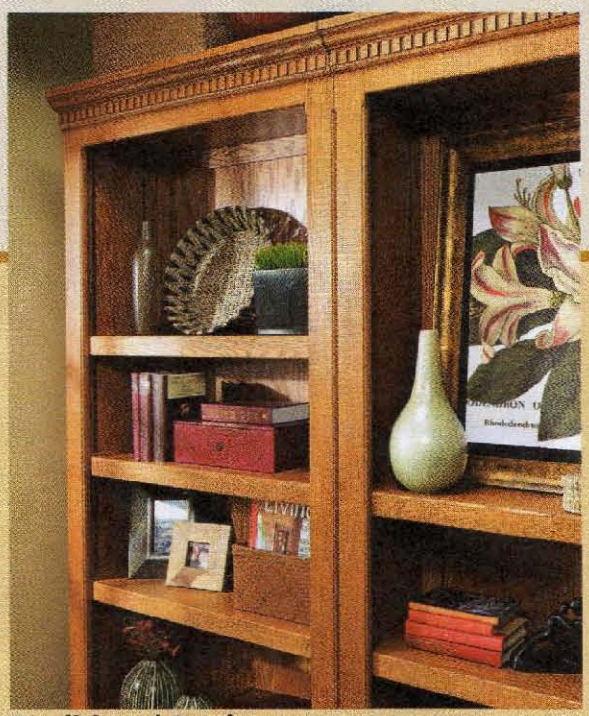
Keepsake Boxes 20

The unique look of these beautiful boxes is guaranteed to draw attention. But that's only part of the story. Building one or both is sure to raise the level of your skills a notch or two.

heirloom project DESIGNER'S NOTEBOOK

Traditional Oak Bookcase. 30

The classic design of this bookcase is a bit deceptive. The techniques, joinery and materials used to build it are thoroughly modern. It goes together easily and will last a lifetime.



Traditional Bookcase page 30

editor's note
Sawdust

A while back, I saw some very attractive boxes that were made out of contrasting woods. I thought that something similar might make an interesting project for *Woodsmith*. So I asked one of our designers to come up with a concept for a small, lidded box. Instead, he came back with a half dozen or so different sketches. All of them were built around the same basic box design, but had different lid treatments. And while they all looked nice, there were a couple that seemed to stand out from the rest.

Ordinarily, we would have just picked one version. But the two boxes that drew the most attention were very different in style, and we couldn't all agree on which one to go with. Some of us favored the box that featured a gracefully curved handle inlaid into the top. Others liked the cleaner, simpler lines of the box with the laminated plywood top and bottom.

To make a long story short, we decided to let you make the choice and include plans for both boxes. Part of the reasoning is that even though the look of the boxes is quite different, a lot of the basic construction is identical. So no matter which box you build, you'll start with the same tried and true techniques. Then later on, you'll get a chance to branch out into something new and different.

For example, one of my favorite tricks is the way the lipped lid is made. It actually starts as part of the box. Then the lid is separated at the router table creating a perfect, snug-fitting match. It's a simple but clever technique that you can apply not only to this project, but to just about any box you make.

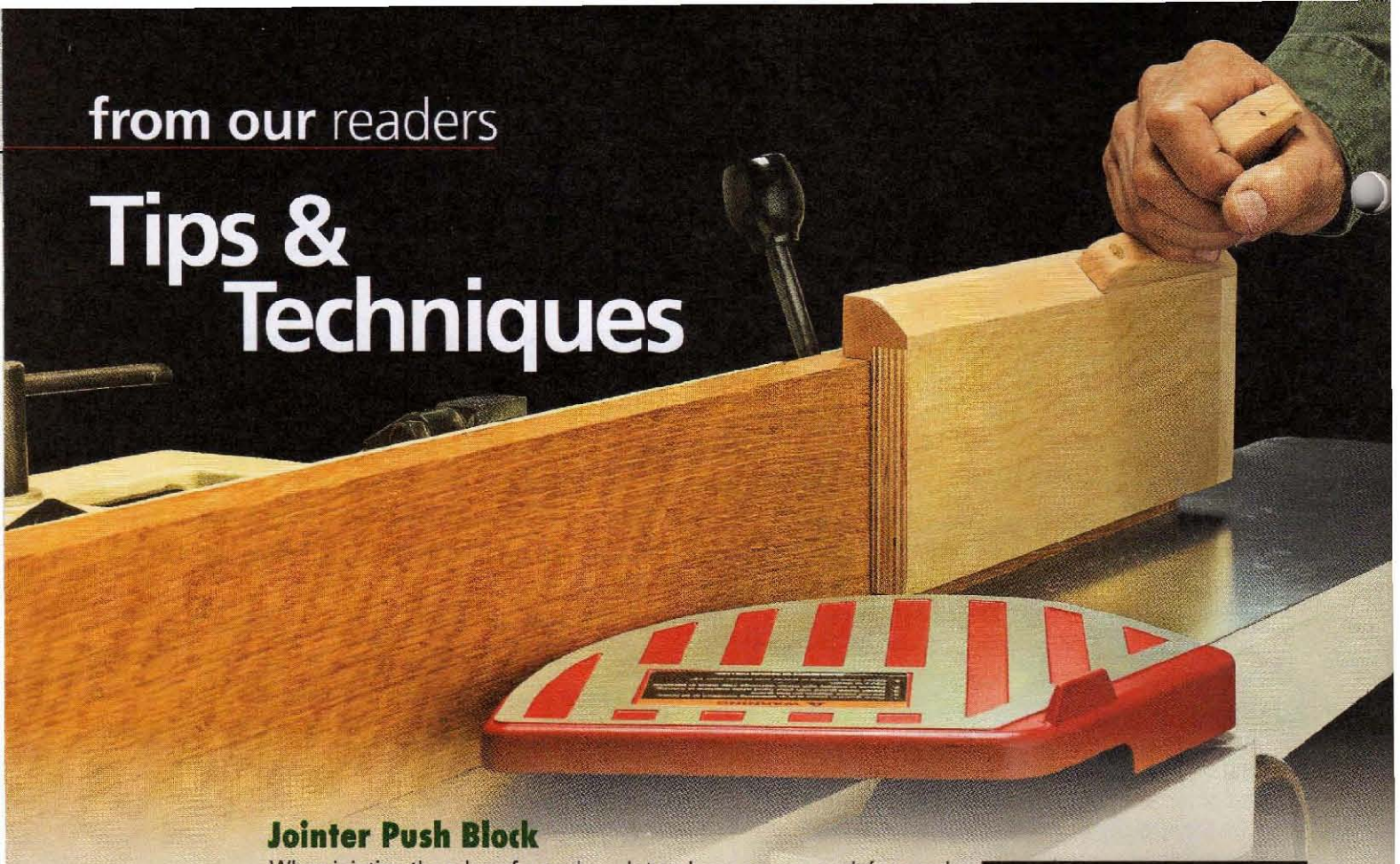
And one final note. Once the two boxes came back from the shop, we all finally agreed on one thing — they both look fantastic.

Terry

Woodsmith GO ONLINE EXTRAS

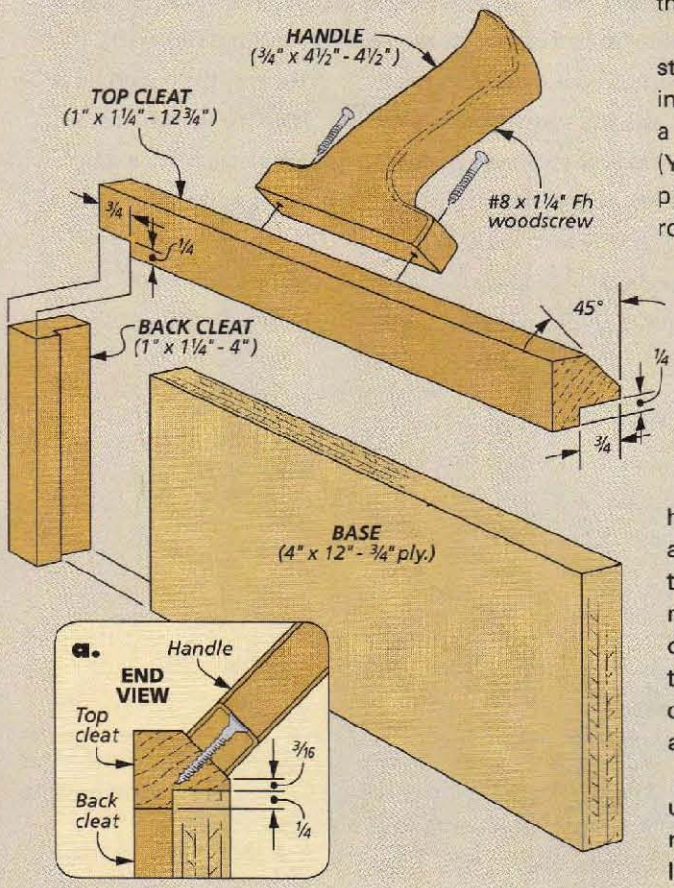
This symbol lets you know there's more information online at Woodsmith.com. There you'll see step-by-step videos, technique and project animation, bonus cutting diagrams, and a lot more.

Tips & Techniques



Jointer Push Block

When jointing the edge of a workpiece, there are three things that I concentrate on. I need to apply consistent downward pressure, lateral pressure, and forward motion to keep the workpiece aligned with the fence. This simple push block addresses all three of these issues when jointing.



Building the push block is pretty straightforward. As you can see in the left drawing, you start with a rectangular piece of plywood. (You can change the width of the plywood to accommodate narrower or wider workpieces.) The hardwood cleats are rabbeted on one edge to fit over the plywood and form the recess that captures the workpiece. They're glued in place.

The top cleat has a 45° bevel on the outside edge for the handle. Attaching the handle at an angle allows you to apply pressure at the back and top of the workpiece where it's most needed to guide the board over the jointer knives. I shaped the handle to fit my hand for a comfortable grip. Then you can attach it with screws.

This push block can also be used on the router table when routing a workpiece on edge. It will keep the workpiece flush against the fence and the table, while your hands are well away from the spinning router bit. You can also use it as a push block on the table saw when cutting grooves or rabbets in an edge.

With this new push block, I now have a tool that lets me work safely with the workpiece on edge.

Jay Sullivan
Washington, North Carolina

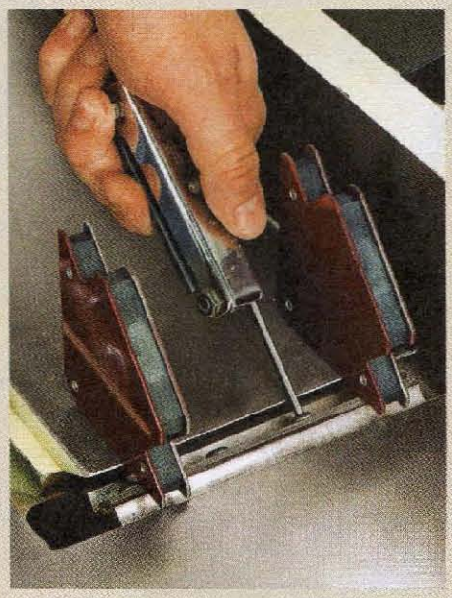
Jointer Knife Setup Tool

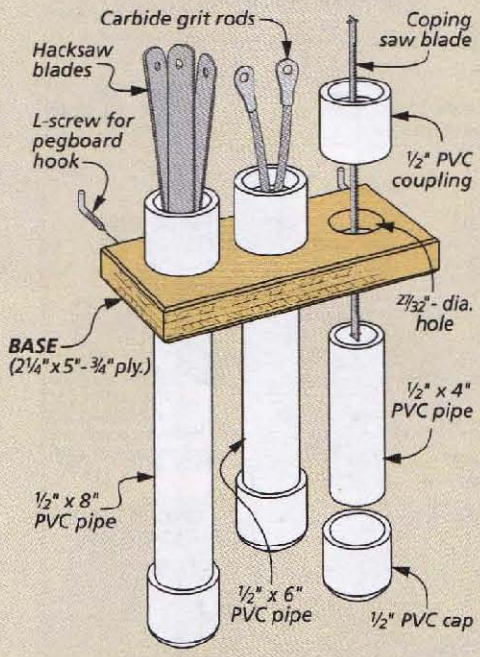
When changing the knives in my jointer, I find that I need an extra set of hands — one to hold the knives and another to tighten the locking screws at the same time. But a couple of welding magnets, like the ones shown in the photo at right are just the thing to help with this task.

These super strong magnets will hold the jointer knives perfectly level with the outfeed table while you tighten the bolts. This way, you don't have to touch the knives. And you'll be certain the knives are placed in the correct position.

You can find magnets like these wherever welding supplies are sold.

Doug Spencer
West Jordan, Utah





Small Blade Storage Rack

Keeping track of small saw blades in my workshop is always a challenge. The packages they come in fall apart quickly. And the narrow blades get lost, bent, and dull in drawers. So I made these storage tubes (left drawing) to keep the blades in top shape and within easy reach.

The tubes are short lengths of PVC pipe with caps glued on to close the bottom. Slip the pipe through matching holes in a plywood base and then glue a coupling to the pipe to hold it in place. L-hooks in the back of the plywood base allow the rack to hang on a pegboard panel.

With this rack, I now have a secure place to keep small, loose blades.

Karl Gabel
Henderson, Nevada

SUBMIT YOUR TIPS ONLINE

If you have an original shop tip, we would like to hear from you and consider publishing your tip in one or more of our publications. Go to:

Woodsmith.com
Click on the link,
"SUBMIT A TIP"

You'll be able to tell us all about your tip and upload your photos and drawings. You can also mail your tips to *"Woodsmith Tips"* at the editorial address shown at right. We will pay up to $200 if we publish your tip.

FREE TIPS BY EMAIL

Now you can have the best, time-saving secrets, solutions, and techniques sent directly to your email inbox. Just go to **Woodsmith.com** and click on *"Sign Up for Free E-Tips."* You'll receive one of our favorite tips each week.

Woodsmith

No. 185 October/November 2009

PUBLISHER Donald B. Peschke

EDITOR Terry J. Strohman
MANAGING EDITOR Vincent Ancona
SENIOR EDITOR Ted Raife
ASSOCIATE EDITOR Dennis Perkins
ASSISTANT EDITOR Carol Beronich
CONTRIBUTING EDITORS Bryan Nelson, Phil Huber, Randall A. Maxey, Joel Hess, Catherine Seiser
EDITORIAL INTERN Brianna Nelson

EXECUTIVE ART DIRECTOR Todd Lambirth
SENIOR ILLUSTRATORS David Kreyling, Dirk Ver Steeg, Harlan V. Clark, Peter J. Larson, David Kallemyn
SENIOR GRAPHIC DESIGNER Bob Zimmerman
GRAPHIC DESIGNER Shelley Cronin
GRAPHIC DESIGN INTERN Megan Leafgreen

CREATIVE DIRECTOR Ted Kralicek
SENIOR PROJECT DESIGNERS Ken Munkel, Kent Welsh, Chris Fitch, Jim Downing, Mike Donovan
PROJECT DESIGNER/BUILDER John Doyle
SHOP CRAFTSMEN Steve Curtis, Steve Johnson
SENIOR PHOTOGRAPHERS Crayola England, Dennis Kennedy
ASSOCIATE STYLE DIRECTOR Rebecca Cunningham
SENIOR ELECTRONIC IMAGE SPECIALIST Allan Ruhnke
PRODUCTION ASSISTANT Minniette Johnson
VIDEO EDITOR/DIRECTOR Mark Hayes, Nate Gruca

Woodsmith® (ISSN 0164-4114) is published bimonthly (Feb., Apr., June, Aug., Oct., Dec.) by August Home Publishing Company, 2200 Grand Ave, Des Moines, IA 50312.
Woodsmith® is a registered trademark of August Home Publishing.

Copyright© 2009 August Home Publishing Company. All rights reserved.

Subscriptions: Single copy: $4.95. One year subscription (6 issues), $24.95. (Canada/International add $10 per year, U.S. funds.)
Canadian Subscriptions: Canada Post Agreement No. 40038201. Send change of address information to PO Box 881, Station Main, Markham, ON L3P 8M6.
Canada BN 84597 5473 RT
Periodicals Postage Paid at Des Moines, IA, and at additional offices.
Postmaster: Send change of address to *Woodsmith*, Box 37112, Boone, IA 50037-2112.

WoodsmithCustomerService.com

ONLINE SUBSCRIBER SERVICES

- **VIEW** your account information
- **RENEW** your subscription
- **CHECK** on a subscription payment
- **PAY** your bill
- **CHANGE** your mailing or e-mail address
- **VIEW/RENEW** your gift subscriptions
- **TELL US** if you've missed an issue

CUSTOMER SERVICE Phone: 800-333-5075

SUBSCRIPTIONS
Customer Service
P.O. Box 842
Des Moines, IA 50304-9961
subscriptions@augusthome.com

EDITORIAL
Woodsmith Magazine
2200 Grand Avenue
Des Moines, IA 50312
woodsmith@woodsmith.com

AUGUST HOME PUBLISHING COMPANY

Printed in U.S.A.

Lathe Tool Caddy

I was looking for a handy place to store my lathe tools that would keep them close by when I needed them, but easy to put away when I didn't. So I built the rolling tool caddy pictured below.

The caddy consists of several plywood disks with holes drilled to accept tools, as you can see in the drawing below. Sections of PVC pipe separate the disks. The caddy is held together by a piece of threaded rod running through the center, with a nut and washer on each end.

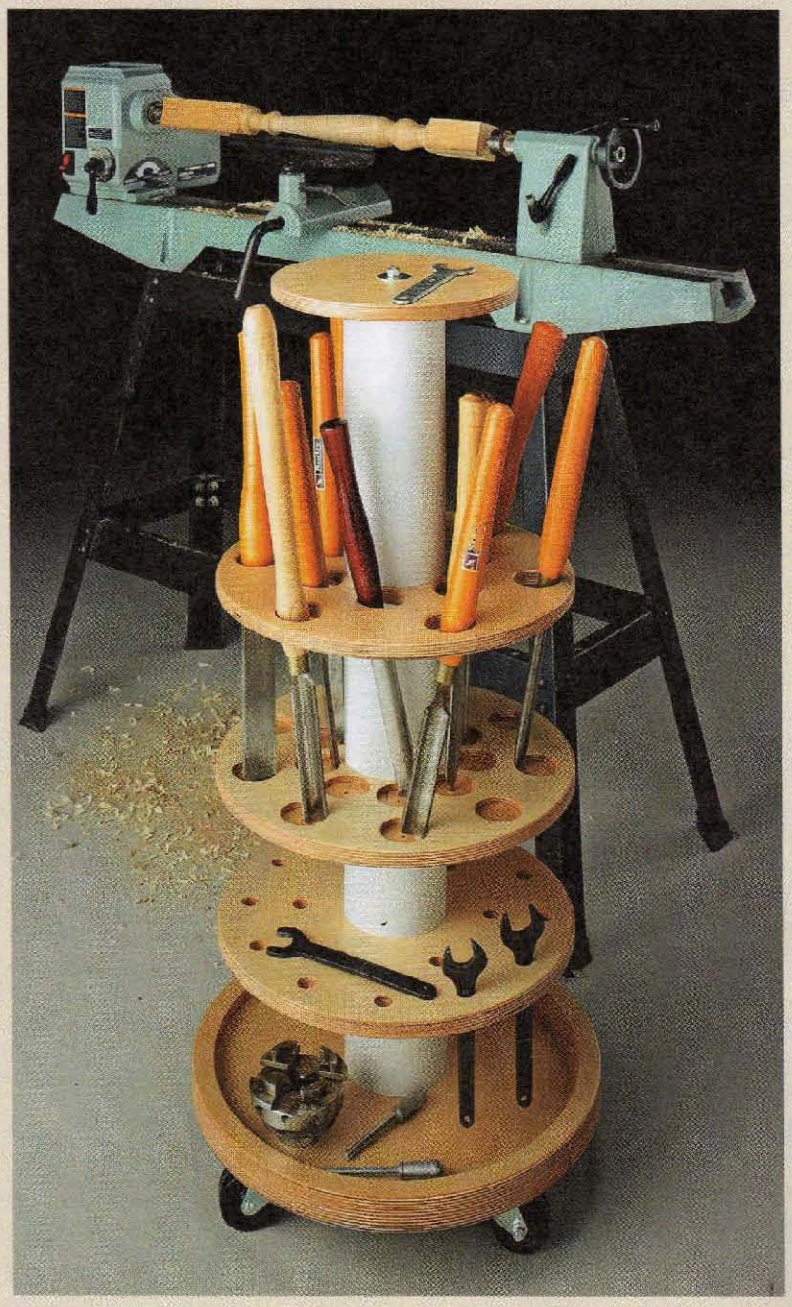
The base is built from two layers: The first is a solid disk. A ring is cut from a second disk of the same size, then glued to the base to keep tools contained on the bottom. (Save the center of the ring to make the top.)

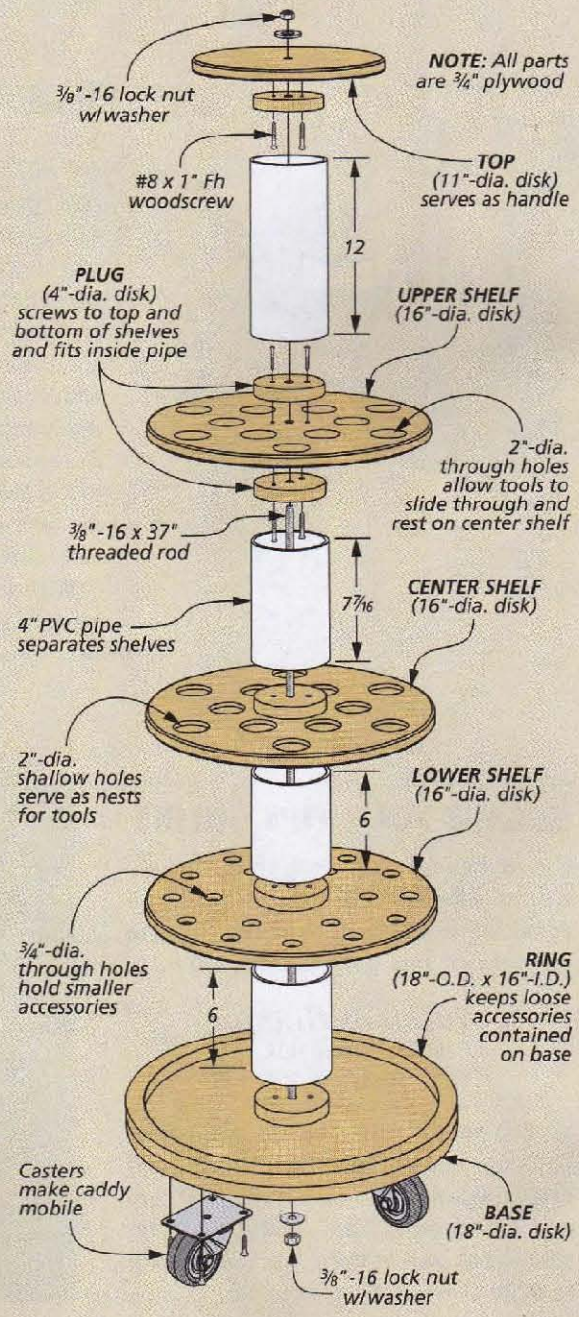
The three center shelves are all the same size. The upper shelf has through holes drilled in it, while the center shelf has shallow holes to hold tools upright. The lower shelf has small holes for wrenches and other accessories.

To hold all the components in place and allow the threaded rod to pass through to the base, plugs are cut to fit inside the PVC pipe. You can add the casters last.

With this new mobile caddy, my lathe tools are organized and within easy reach.

Dave Gahimer
Rockville, Indiana





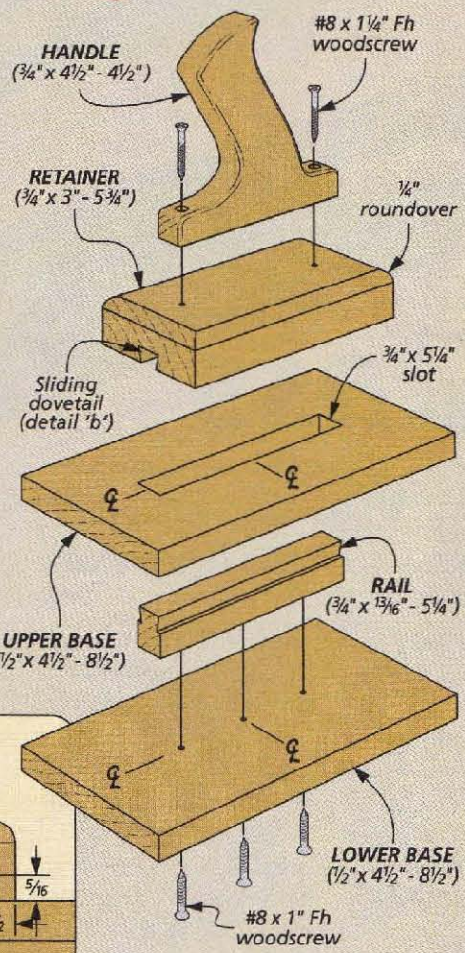
Sanding Block

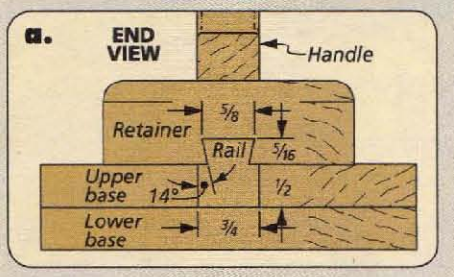
I wanted a hand sanding block that uses ordinary sheets of sandpaper. Instead of buying one, I decided to make my own. The sanding block you see in the photo at right is the result.

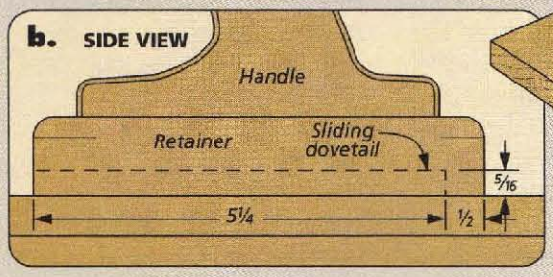
The block uses an interlocking design to clamp the ends of the sandpaper. The two base pieces lock together with a sliding dovetail created by a rail and a retainer that doubles as the handle. As you can see in the right drawing, the rail fits through a slot in the upper base and the retainer slides over the rail. This keeps the sandpaper flat and allows me to use the maximum sanding area of the paper.

With this shop-made sanding block, my sanding projects turn out flatter. Plus, the sandpaper lasts longer in the block.

Richer Roy
Crabtree, Quebec







Win This Bosch *Impactor* Driver

That's right, send us your favorite shop tips. If your tip or technique is selected as the featured reader's tip, you'll win a *Bosch* impact driver just like the one shown here. To submit your tip or technique, just go online to *woodsmith.com* and click on the link, "SUBMIT A TIP." You can submit your tip and upload your photos for consideration.

The Winner!

Congratulations to Richer Roy, winner of the *Bosch Impactor* driver. To find out how you could win a *Bosch* driver, check out the information on the left.

Quick Tips

QUICKLY CLEAN SAW BLADES

I never look forward to removing the built-up pitch from saw blades. It takes time to soak and scrub each tooth with a wire brush. But I found a much faster way to do this time-consuming job.

A brass wire wheel brush chucked in a power drill removes the pitch and sawdust in just minutes. I clamp the saw blade in a vise and run the brush over the teeth from the back side. This way the brush can get in close to the back of each tooth tip.

John Felton
Sheboygan Falls, Wisconsin

KEEP THAT PENCIL SHARP

Having a sharp pencil on hand to mark workpieces is an absolute must for a woodworker. But you don't always need to head over to the pencil sharpener to touch up the tip of your pencil.

Instead, I attached a piece of self-adhesive sandpaper to the front of my workbench to sharpen just the graphite tip. You can sharpen the graphite over and over again without leaving your work area. And the sandpaper will last for years.

Edward Alexander
Smithville, Texas

BETTER GLUE ROLLER

Like a lot of woodworkers, I use a paint roller to spread glue over large surfaces. But an ordinary roller soaks up a lot of glue and it's difficult to wash out. I often end up throwing it away after only one use. So instead of using an ordinary roller cover, I cut a piece of 1½" PVC pipe to fit over a standard paint roller cage.

The pipe spreads the glue evenly and smoothly. And it doesn't waste glue. Only a thin film will stay on the pipe. When the glue dries, it peels off easily, so the roller can be used again and again.

Robert Conroy
Telford, Pennsylvania

choosing the right Glass

Wood and glass can be a very appealing combination. Here's what you need to know to make them work together successfully.

Combining wood and glass in a project can result in something really special. Glass adds to both the function and the aesthetic appeal. For example, glass door panels and shelves can give a cabinet a lighter, more open feel while showing off the contents. And nothing beats the contemporary look and durability of a glass tabletop.

But just like wood, all glass is not the same. So when adding glass to a project, it's important to match the type of glass you use to its function as well as the effect you're trying to create. This simply involves knowing what the choices are and then following a few general guidelines.

Thick, glass panels framed in wood make an attractive and durable tabletop.

THREE QUESTIONS. When choosing and ordering glass, there are essentially three choices you have to make. You need to decide what thickness to use, if the glass needs an edge treatment, and whether to order standard or tempered panels. The answers will depend on how the glass is used in a project. So let's take a look at the options and see how they enter into your choice.

WHAT THICKNESS? You can purchase sheet glass in a variety of standard thicknesses — from 3/32" up to 1" thick. Two of the commonly used thicknesses are referred to as single strength and double strength. Single-strength glass is the standard for windows and measures about 3/32" thick. Double-strength glass is a slightly thicker (1/8") and consequently a bit stronger.

When installing glass in cabinet doors, it should be rigid enough to resist breaking, but also light in weight. Either single- or double-strength is suitable, but I generally prefer the thicker type. As well as being stronger and less likely to break, double-strength glass is also stiffer. You'll hear less "rattle" when a door is opened and closed. And a practical motive is that the 1/8" thickness of double strength panels is easier to design and build around. The slight difference in cost weighed against the advantages makes this an easy decision.

For use in a picture frame, limiting weight can be a goal and strength and stiffness generally aren't an issue. So here, single-strength glass can be a good choice. You'll also get less distortion from the thinner glass. But again, if you want to "standardize" your dimensions, choose double-strength.

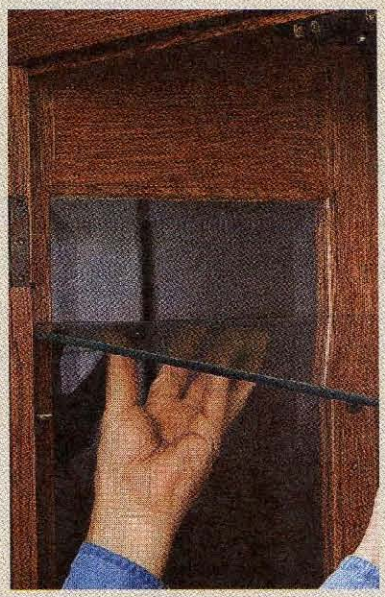
GO THICKER. When a glass panel has to be self-supporting or support the weight of other objects such as with a shelf or a tabletop, thicker glass is usually necessary. Ordinary glass that's 1/4" thick or more is often referred to as plate glass. But other than increased strength, rigidity, and cost, it's made no different than thinner glass.

For shelves that will bear a light to moderate load, 1/4"-thick glass is the standard. If the load is heavier, books for example, you can up the

thickness to ⅜" or more. A thicker panel can also give a shelf a stronger visual presence.

Likewise, glass used for a tabletop should be thick enough to handle the load. If it's supported in a frame, ¼" is my choice. When glass alone forms the top of the table, ⅜" and upward might work better. The key here is that you want the thickness of a "stand-alone" glass top to be a good match to the size and proportion of the table.

AN EDGE PROFILE? Using thicker glass for a tabletop or shelves leads to the second topic. When a glass panel is permanently fixed in a frame, the sharp, possibly irregular edges are completely concealed. But when the edges of the glass panels are exposed both physically and visually, you'll want to consider an edge profile, as shown in the photos at right.



The pencil edge on this ¼"-thick glass shelf complements the clean, refined look of this china cupboard.

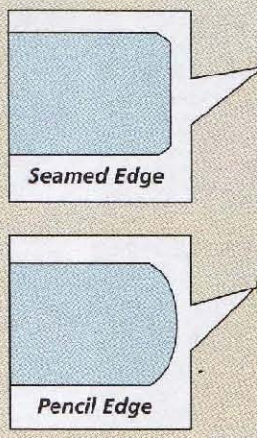
This can be as simple as softening the sharp corners (called seaming) or having a more elaborate ground and polished profile added. Here you have a number of choices including flat, rounded (called a pencil edge), or chamfered.

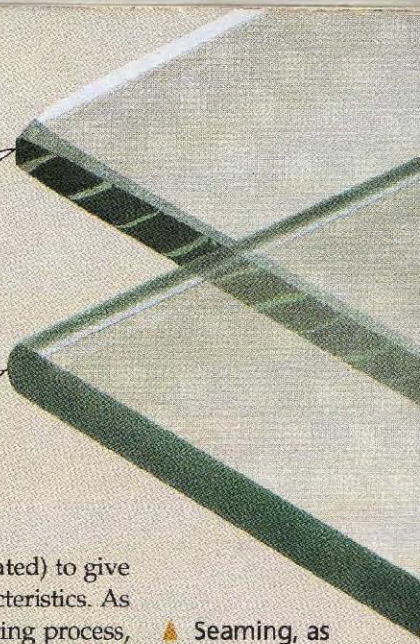
Since the edges of the panels are mostly hidden, drop-in glass panels in a framed tabletop can simply be seamed. Likewise, you can often get by with this inexpensive treatment on glass shelving. When a tabletop has exposed edges or you're ordering shelves for a more refined project, you'll want to consider a ground and polished profile, as in the photo at left.

OR A BEVEL? Although not strictly an edge treatment, adding beveled glass to a project falls into this category. Here, a shallow bevel is ground into the surface at the edges of a thick glass panel — similar to a raised door panel.

As you see in the lower margin photo at right, the beveled edges add a subtle highlight to the glass door and case panels. A beveled edge is also an option for a glass tabletop. And if you want the glass in a project to make a bigger statement, check out the box below.

TEMPERED? The final concern relates to safety and durability. Glass can be tempered (heat treated) to give it two valuable characteristics. As a result of the tempering process, glass will break in a much "safer" way. Instead of creating sharp, jagged shards, tempered glass breaks into small, less harmful chips. An additional benefit is that a piece of tempered glass has four to five times the strength and impact resistance of standard glass.





Seaming, as in the upper example, is the simplest of edge treatments. A smooth, pencil edge on the lower panel is a bit more refined.

There are a couple of instances in which I would recommend using tempered glass. I almost always use tempered glass for a tabletop. It's much less likely to break and cause injury. Second, if you are installing glass panels in doors that are near floor level, make it tempered. Glass at this level is far more susceptible to being accidentally broken.

One downside to tempered glass is that it has to be special ordered from the factory by your supplier. And once glass is tempered, it can't be recut or the edges profiled. So all the details need to be firmed up before you order.

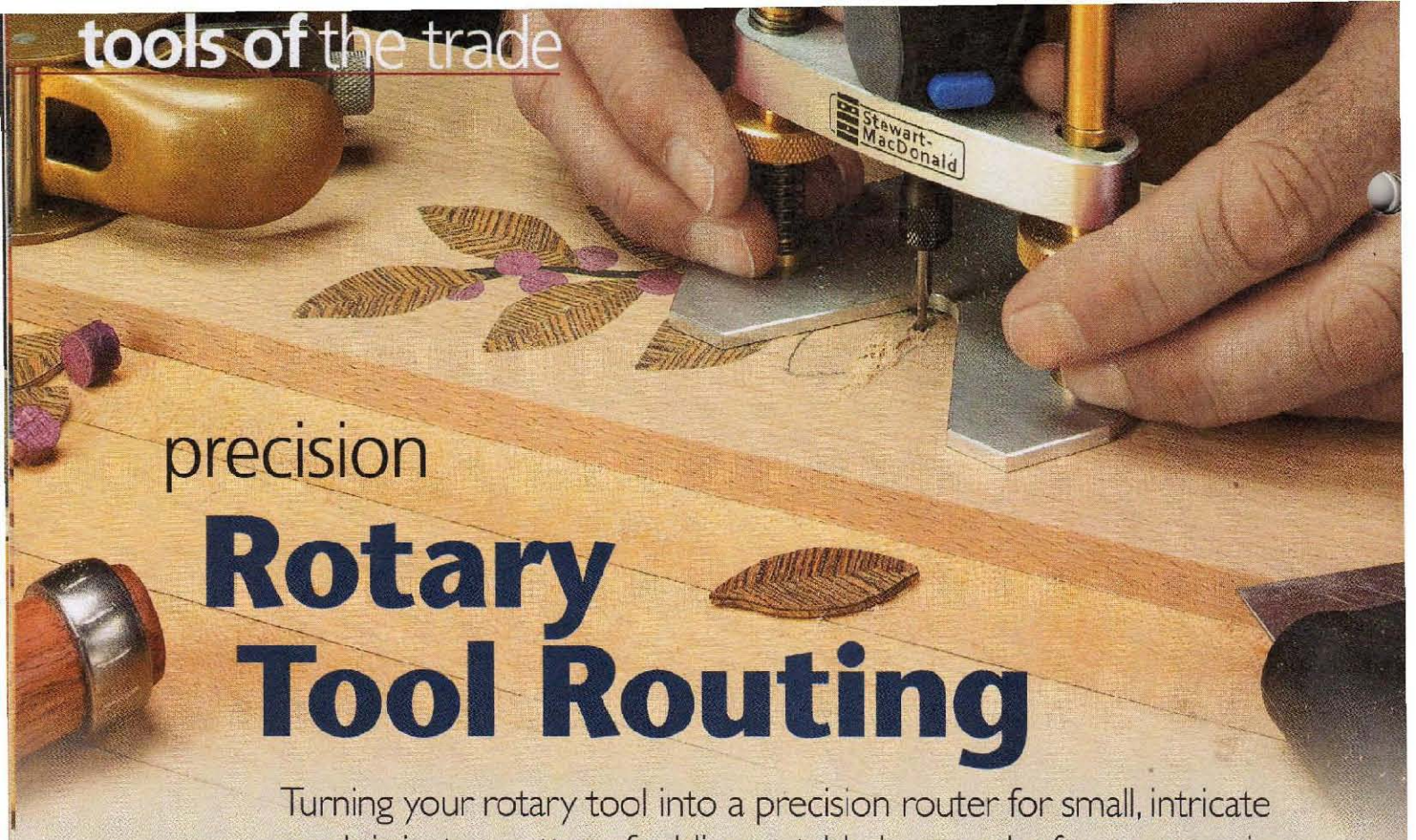
As you would expect, tempered glass is more expensive than ordinary glass, but not a great deal. So any time there's a concern about safety, go with tempered.

The choices are really pretty straightforward compared to some of the other decisions you make when building a project. And that's good. For me, the woodworking should be the focus and the glass a complementary accent. W

The beveled glass in this china cabinet adds subtle depth and detail.

Patterned Glass

When incorporating glass into a project, you don't have to limit yourself to flat, clear glass. Glass with a pattern or texture is available, or it can be frosted or colored. You'll find that the choices are surprisingly varied. This type of glass can work well in a contemporary or even some traditional designs (right photo). When using textured or colored glass, all the same considerations discussed will apply.



precision Rotary Tool Routing

Turning your rotary tool into a precision router for small, intricate work is just a matter of adding a stable base and a few accessories.

The *Stewart-MacDonald* base is available as a kit with an edge guide and air pump for dust control.

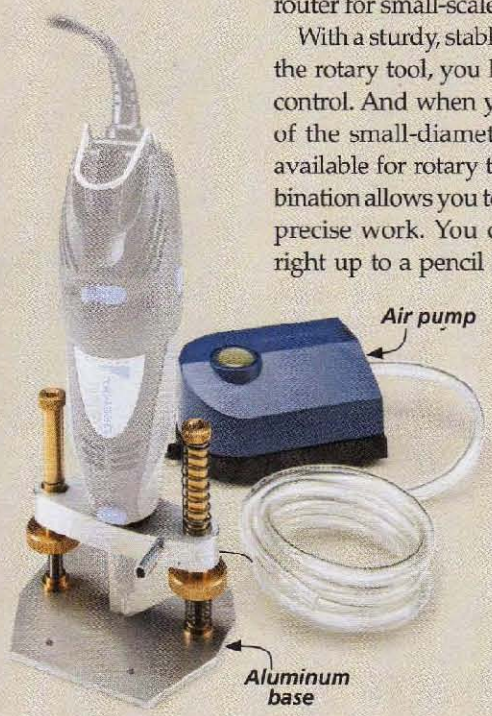
Rotary tools come in handy for a number of woodworking tasks. You can use them to cut, sand, drill, and even carve. But there's another role for the rotary tool that you're sure to find helpful in the shop. By mounting the tool in a specially designed base, it also makes an excellent router for small-scale work.

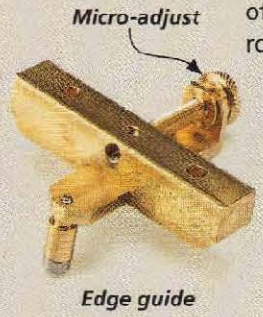
With a sturdy, stable base holding the rotary tool, you have very fine control. And when you install one of the small-diameter router bits available for rotary tools, the combination allows you to do extremely precise work. You can even rout right up to a pencil line — almost unthinkable with a full-size router. This capability allows you to rout hinge mortises without using a jig. And when it comes to adding a decorative inlay to a project, routing the recess is a breeze.

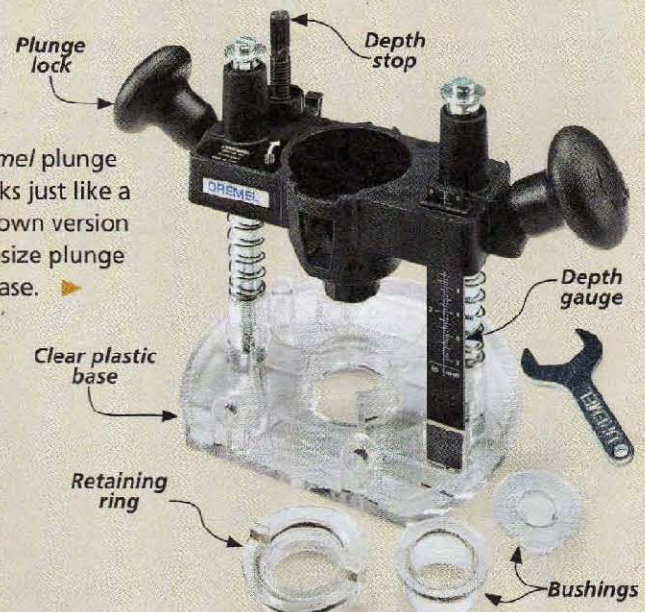
Best of all, there are a couple of options for router bases. One from rotary tool maker *Dremel*, and another from luthier supplier *Stewart-MacDonald*.

DREMEL ROUTER BASE

With a street price of under $30, you get a lot for your money with *Dremel's* plunge router base. The impact-resistant plastic base comes with an edge guide, circle-cutting attachment, and guide bushings. As you can see in the photos below, the *Dremel* design looks just like a scaled-down plunge router, right down to the knobs on the handle.







The *Dremel* plunge base looks just like a scaled-down version of a full-size plunge router base.

CONNECTION. To attach the rotary tool, remove the thread cap on the end of the tool and screw it directly into the housing on the base. This makes installation a breeze. You can go from freehand use to plunge routing in less than a minute.

HOW IT WORKS. In use, the *Dremel* base is a pleasure to work with. It's lightweight, but sturdy enough for most common woodworking tasks. The plunge lock is located on the right handle. Loosen it to lower the router, and then tighten it to lock the depth of the bit. The base even incorporates a depth stop.

ACCESSORIES. The plastic circle-cutting attachment and edge guide both attach to the router base with two steel rods and thumbscrews. Once again, this is similar to many full-size routers. Both work great and are easy to set up.

Dremel also includes a set of guide bushings. I do a lot of template routing, and being able to use the same techniques with a rotary tool and the very small bits makes a lot of sense. But I wish *Dremel* had made them a bit smaller. The 15/16" and 5/8" outside-diameter bushings aren't particularly well suited to small-scale work. A 1/4" bushing would have been more useful.

STEWART-MACDONALD BASE

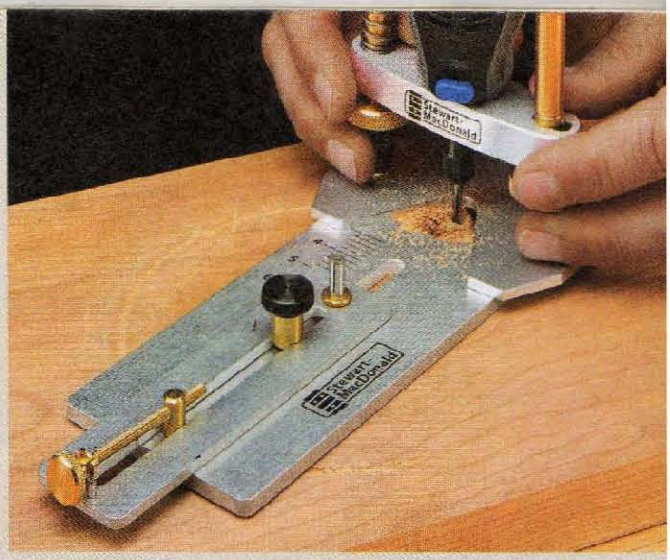
It's no surprise if you've never heard of supplier *Stewart-MacDonald*. Their specialty is providing tools and supplies for guitar and musical instrument makers. As you can imagine, this kind of work demands the highest degree of accuracy. That's why *Stewart-MacDonald* went the extra mile with the construction of their precision router base.

SOLID CONSTRUCTION. Made of nicely machined aluminum with brass height adjusters, you can dial in the depth of cut to hair-splitting levels. Of course, all this quality comes at a significantly higher price. Expect to pay just over $50 for the base alone, or around $100 for a kit that includes the edge guide and air pump. The circle-cutting attachment is sold separately.

INSTALLATION. Just like the *Dremel* base, the rotary tool screws into a threaded housing for easy installation. Another nice feature of the *Stewart-MacDonald* base is the pair of tapped screw holes in the baseplate to attach the accessories.

ATTACHMENTS. I should point out that although the accessories for the *Stewart-MacDonald* base are designed for specific, luthiery tasks, they can also be useful in conventional woodworking, as well. The edge guide and circle-cutting attachments are also brass and aluminum. Both incorporate micro-adjust screws for precise settings and have countersunk screw holes to attach to the base.

▲ *Dremel's* edge guide is easy to adjust. Simply slide the steel rods into position and lock the guide in place. The guide makes routing a narrow channel for string inlay a snap.



▲ You can dial in amazing accuracy with the *Stewart-MacDonald* circle-cutting attachment.

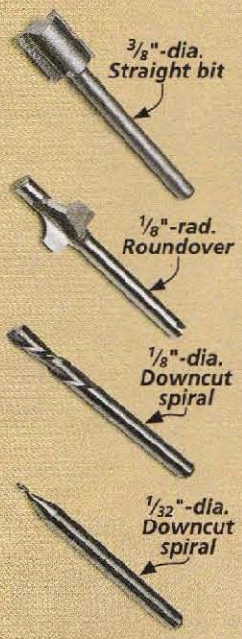
DUST REMOVAL. The small footprint of the *Stewart-MacDonald* base offers great visibility and control. And when you attach the air pump, dust is blown out of the way, so keeping an eye on your layout is never a problem. This is especially helpful when routing inlay work.

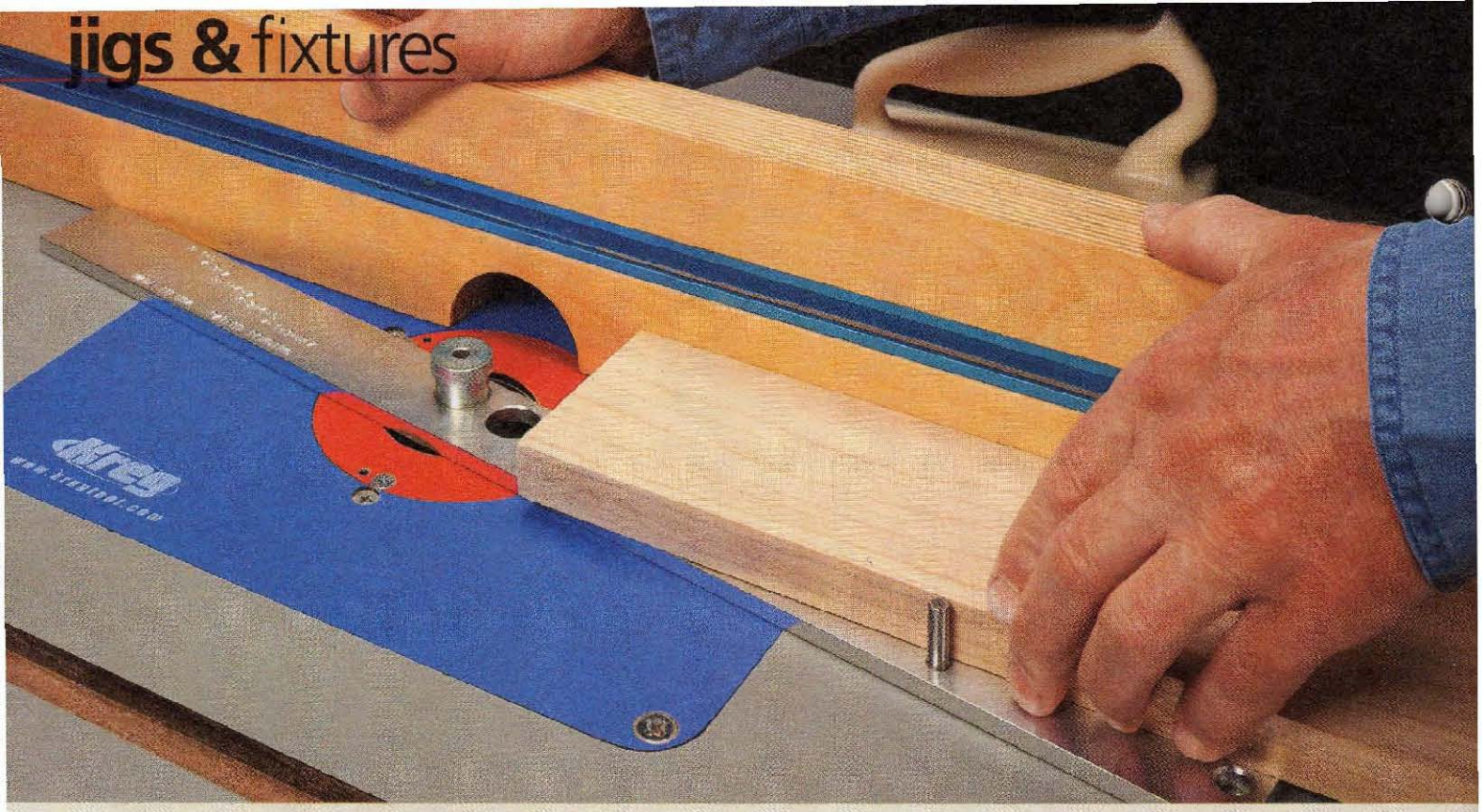
BOTTOM LINE. Both these bases turn your rotary tool into a great mini-router. *Dremel* offers a lot of capability for a low price. And it's plenty accurate for most small-scale applications. But if you're looking for a tool that offers the ultimate in accuracy, you'll find the *Stewart-MacDonald* base well worth the investment. Either way, your projects are sure to benefit.

Precision Bits

Adding a router base to your rotary tool makes it easy to control, but it's the selection of small-diameter bits that really adds a new dimension to woodworking. The bits shown at right are just a sampling of what you'll find in stores and online. Sources, on page 51, will point you in the right direction.

I was a little worried about breaking the small-diameter (1/32") downcut spiral bit, but it plowed through cherry, ebony, and bocote with no problems. One thing to keep in mind, though, is that these bits come with either 1/8" or 3/32" shanks. You need to make sure you have the right collet for the bit.





foolproof **Fluting Jigs**

Creating perfectly spaced flutes on workpieces for a project is easy with your router and these handy jigs.

Fluting is a great way to add an elegant detail to a project with nothing more than a router and a core box bit. But the challenge has always been making sure the flutes are evenly spaced.

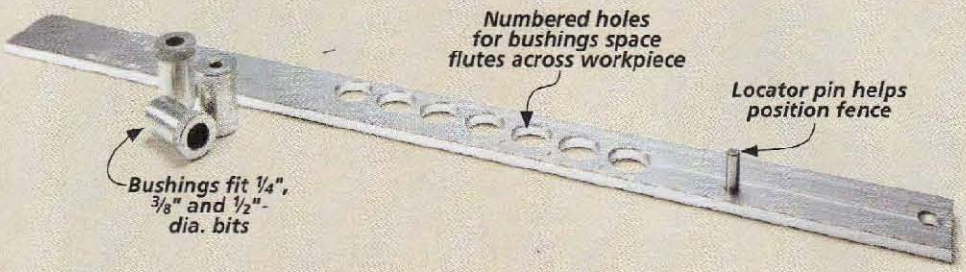
Fortunately, there are several jigs on the market that make this an easy task. One of the easiest to use is the *Automatic Flute Spacing Jig*, from *DRL Group* shown in the main photo above.

Unlike some fluting jigs, the *Automatic Flute Spacing Jig* isn't actually used in routing the flutes. Its purpose is simply act as a set up gauge for the fence to create perfectly spaced flutes without measuring. It will space two to seven flutes on any workpiece up to 12" wide. (For routing flutes with a handheld router, see the jig in the box on the opposite page.)

THE JIG. If you take a look at the photo below, you'll see that the *Automatic Flute Spacing Jig* is simply an aluminum bar with a series of numbered holes, a set of three steel bushings, and a locator pin. Each bushing is designed to fit a different diameter router bit (more on this later). The holes in the base hold one of the bushings during set up.

EQUAL SPACING. You've probably seen the old trick of laying a ruler diagonally across a board to divide it into equal sections. Well, this jig works on the same principle. It positions the router table fence for

▼ The jig includes three bushings to fit different diameter bits.



▲ Suggested fluting combinations are stamped on the face of the set-up jig for 3 to 7 flutes.

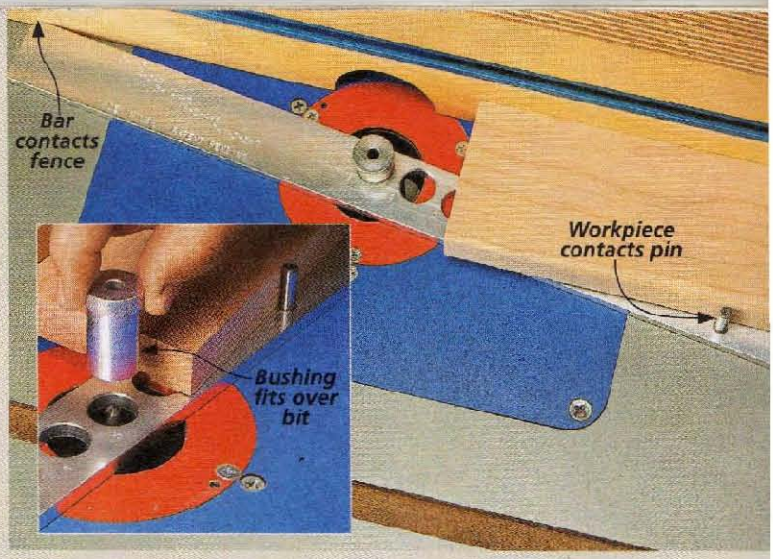
each flute by dividing the width of your workpiece into equal sections. Here's how the jig works.

SET UP. Start by selecting a bushing to match the diameter of the core box bit you're going to use to rout the flutes. Slip the bushing into one of the holes in the jig and over your router bit, as shown in the inset photo at right.

Now, all you have to do is place your workpiece on top of the jig and slide the router table fence up to the edge of the workpiece, sandwiching it between the fence and the locator pin on the jig. The fence is stopped when it contacts the opposite corner of the jig (see photo at right).

After tightening down the fence, you can remove the jig and rout your flute. To rout additional flutes, simply reposition the fence by moving the bushing to a different hole on the jig and repeat the set-up procedure.

HOLE SELECTION. The only tricky part of using the jig is knowing which hole to place the bushing in. Fortunately, the manufacturer specifies the different hole combinations for three-, four-, five-, six-, and seven-flute applications right on the jig (lower right photo on opposite page). Using these combinations will give you evenly spaced flutes across the width of the workpiece.



▲ The set-up bar pivots on a bushing that fits over the router bit (inset photo). You move the fence until the corner of the bar contacts the fence at the workpiece.

▲ After routing the first, centered flute, reposition the fence with the jig and make the rest of the flutes.

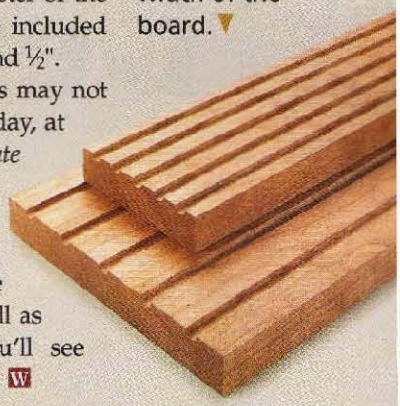
FLUTE SPACING. Because the jig uses the workpiece to position the fence, the flute spacing is fixed based on the width of the workpiece and the number of flutes you rout. (See the margin photo at right for an example of this.) This means you can't precisely locate the spacing of the flutes.

However, you can vary the spacing to some extent by not using certain holes. You can also use the jig to rout flutes along the edge of a board, or exactly down the middle of your workpiece.

BIT OPTIONS. Most of the time, I use a core box bit for routing flutes. But the *Automatic Flute Spacing Jig* will also work with straight bits or V-groove bits. However, you are limited by the diameter of the three bushings that are included with the jig — ¼", ⅜", and ½".

PRICE. Even though this may not be a jig you use every day, at $30, the *Automatic Flute Spacing Jig* won't break the bank either. (See page 51 for sources.) And you'll appreciate the time it saves, as well as the perfect results you'll see when the job is finished. W

The spacing of the flutes is determined by the number of flutes and the width of the board. ▼



Worth a Look: Rockler Fluting Jig

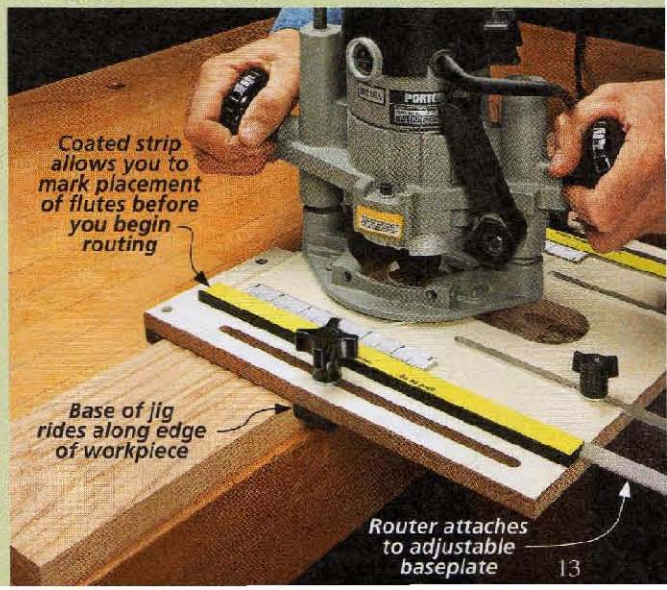
Routing evenly spaced flutes on the router table is a snap with the jig shown above. But you can also get the job done with a handheld router and the jig shown in the photo at right made by *Rockler*.

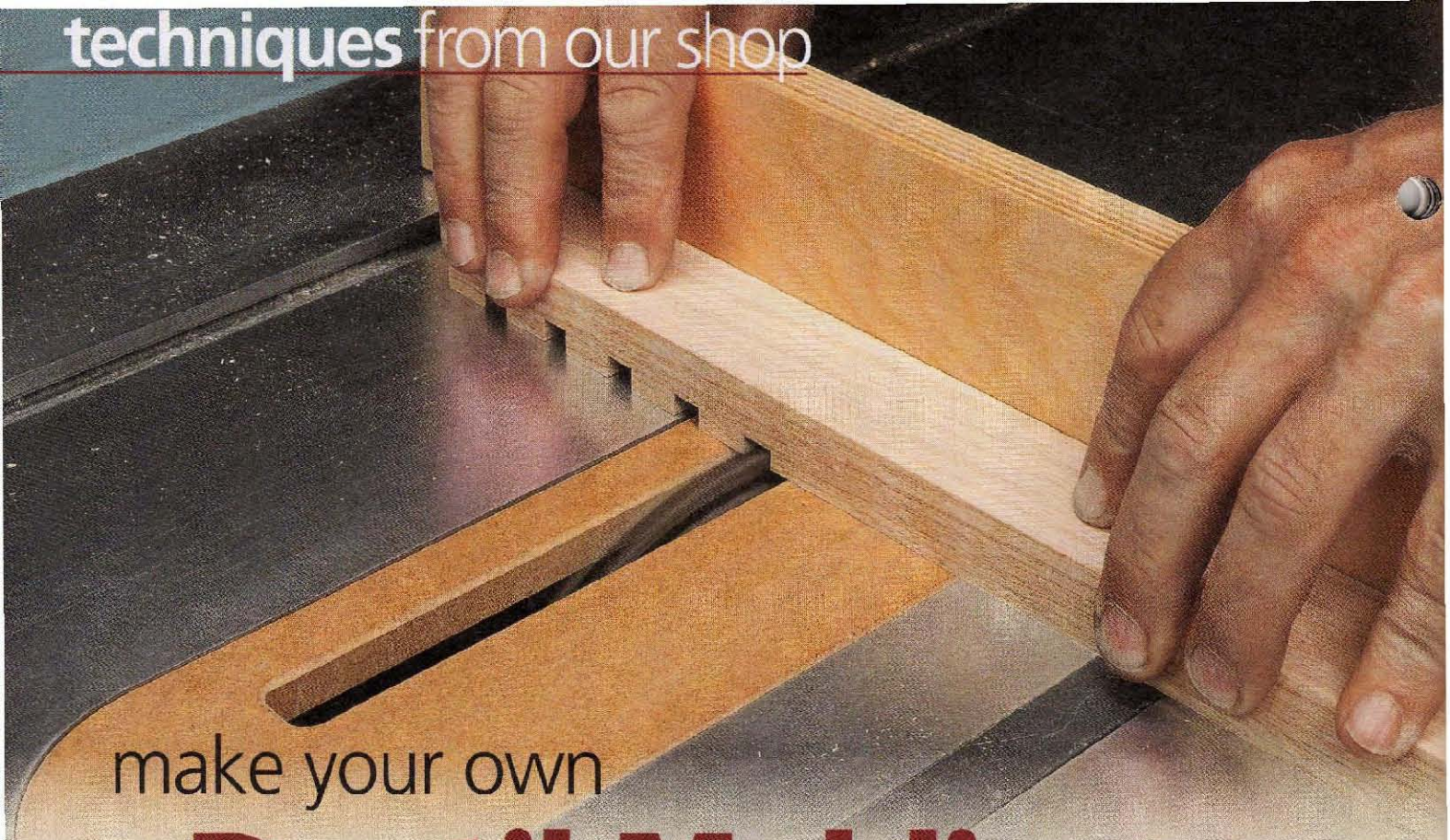
This handheld router jig straddles the workpiece and allows you to use a plunge router for stopped flutes. It can also be used to rout grooves along the length of a workpiece.

The base of the jig is designed with a fixed fence on one side and a sliding fence on the opposite side. These work together to trap the workpiece. The router attaches to the jig through pre-drilled holes in the clear, sliding baseplate.

To use the jig, first locate the center of the workpiece and mark it on the coated yellow strip. From there, you can decide where you want to place the flutes and mark the strip accordingly. Then it's just a matter of lining up the baseplate with your marks and routing the flutes. For easy positioning, the pre-drilled mounting holes on the baseplate align the bit with the "zero" mark on the factory-attached ruler.

For information on buying this jig, refer to Sources on page 51.





make your own Dentil Molding

With a simple jig for the table saw, you can create custom-designed molding that's a perfect match for your projects.

Dentil molding has been a staple of fine furniture for centuries. Characterized by a series of regularly spaced blocks, dentil molding has its roots in architectural design. From stone construction to interior ceiling molding, the dentil pattern eventually found its way into furniture design. (The bookcase on page 30 features one example.) And the good news is, you can easily make dentil molding for your projects at the table saw with a simple jig.

▼ Dentil molding is simply a series of blocks and spaces.

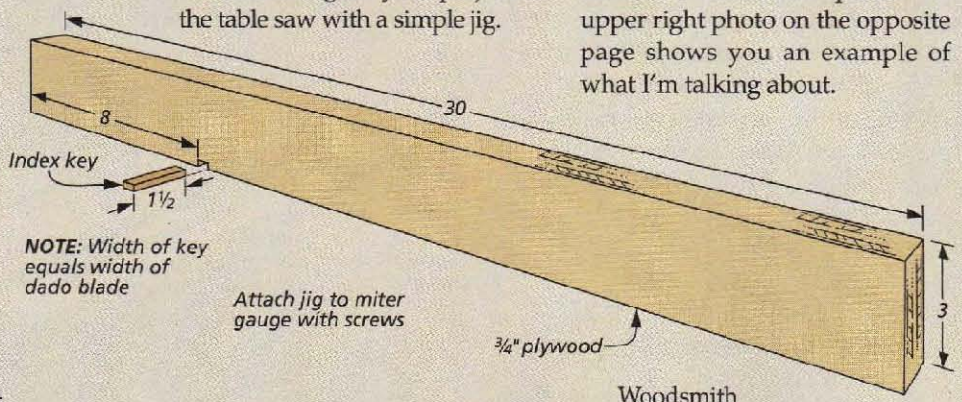
MAKING THE JIG

If you take a look at the dentil molding in the photo at left, you can see that it's a lot like one half of a box joint. So it's no surprise that the jig used to cut the molding is also very similar. It consists of an auxiliary fence attached to the miter gauge and an index key to evenly space the cuts. Unlike box joints, however, you can vary the size of the blocks and spaces. The upper right photo on the opposite page shows you an example of what I'm talking about.

DESIGN FIRST. The starting point for making molding is to determine your design. Begin by drawing a simple layout of the blocks and spaces, keeping them in proportion to your project. Then you can build the jig to suit the design.

In most cases, you'll want the molding to have a full block on each end, so you'll need to account for this in the design. (The bookcase is an exception. I trimmed the ends of the molding at a half space so the pattern was continuous when two bookcases stood side-by-side.)

BUILDING THE JIG. Once you've finalized the design of the molding, you can move on to building the jig. The place to start here is the fence. I used plywood, but MDF is also a good choice. You can cut the fence to the dimensions shown in the drawing at left.



Start by cutting a notch for the indexing key. This key and notch determine the size of the spaces between the blocks in the finished molding. To cut the notch, set a dado blade to the desired width and make a cut in the fence.

The notch should be just a little shallower then the depth of the space in your molding design. This way, once you start cutting the molding, the workpiece will fit over the key and sit flat on the table saw for more consistent results. Now you can cut the key out of a scrap of hardwood and install it in the notch with a dab of glue.

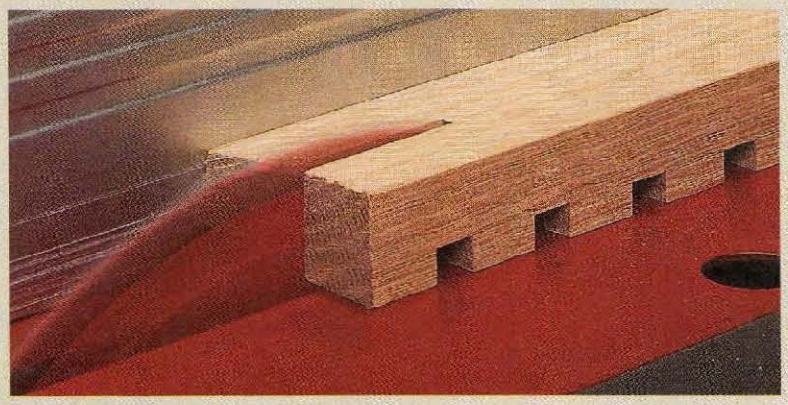
POSITION THE KEY. How far you position the key from the blade determines the size of the blocks, so you'll need to refer to your design again. Then make two marks on the face of the fence where it will meet each edge of the blade. Next, simply line up the marks with the blade and attach the fence to the miter gauge in this position (left drawing, below).

CUTTING THE MOLDING. Once you've completed the jig, making a strip of dentil molding is pretty straightforward. It's simply a matter of positioning the workpiece against the index key and making the first cut, forming a block. Then you just place the freshly cut notch over the index key and repeat the process over the length of the molding.

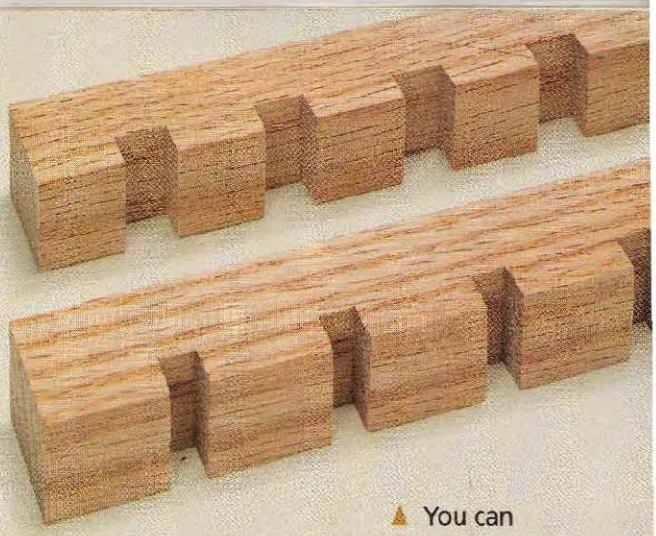
The photo below shows an easy way to make several identical pieces of molding. Just start by cutting the pattern in a wide blank and then rip it into thinner strips.

DESIGN VERSUS REALITY. As simple as cutting the molding is, there is still one thing to be mindful of. When cutting a long strip of molding, any slight measuring errors in the size of the dado or spacing of the pin will result in a cumulative error over the length of the molding (ending with an incomplete block or space). One way to prevent this is to lay out the full pattern on a test piece. Using the test piece, you can check your progress while cutting and make any adjustments.

Whether it's used alone or combined with other molding profiles, dentil molding is an easy way to add a distinctive look to your future projects. W

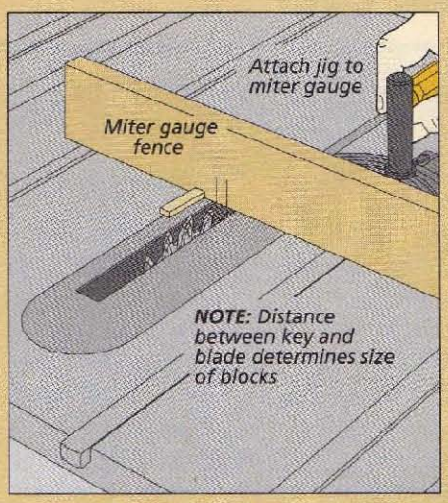


▲ If you need multiple pieces of molding for a project, it pays to start with an extra-wide blank. Just cut the dentil pattern in the blank and then rip the individual strips to final width.

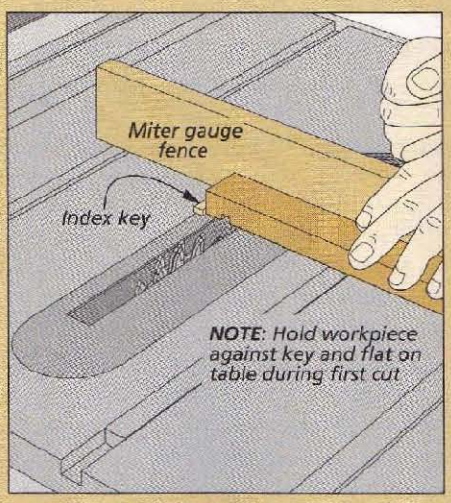


▲ You can change the look of the molding by varying the size of the blocks and spaces.

How-To: Make Dentil Molding on a Table Saw



Attach the Fence. *After installing the index key, carefully measure the distance from the blade and attach the fence.*



Start with a Block. *Butt the workpiece up against the key and make your first cut, creating a full block on one end.*

Keep it Moving. *Complete the molding by repositioning the workpiece over the key after each successive pass.*

tower Candle Stands

This project may be small in size, but it still offers the opportunity to use some big-time woodworking skills and techniques.

I always enjoy building small projects. You get to use all the woodworking skills at your disposal but on a scale that requires less effort, goes a lot quicker, and doesn't take a big bite out of your wallet.

If you need convincing, take a look at the attractive set of candle stands in the photo above. At first glance, you notice the stylish details — the contrast between the figured maple of the bases and the dark hardwood of the window grilles, and how the configuration of the grilles adds interest to the window openings.

What's easy to miss is all the woodworking that goes into building the stands. It begins with the miter joints used to assemble the bases and continues right through the half laps used to make the window grilles. I guarantee you'll get your fill of quality shop time with an impressive project as the proof.

ONE, TWO, OR THREE. Before you can get started, you have a basic decision to make — whether to build just one candle stand, two, or all three. Let me point out one design feature that favors making the full set. The only difference between the three stands is their finished height. So making all three stands is simply a matter of repeating the same cuts using the same setups on a few more workpieces.

THE BASES

Building the mitered bases is your first task. There are several different ways you can approach this. But to me, it makes the most sense to do the inside cuts on extra-wide blanks, and then bevel the pieces to their final width. This way, you'll be more likely to end up with clean, crisp miter joints.

ROUGH WIDTH. I began by cutting the sides for each stand to rough width (4½") and finished length from ½"-thick stock, as shown at right. A stop block clamped to the miter gauge will ensure the sides are identical in length. And then take a minute to arrange the sides for the best appearance and label them. I clearly marked the mating corners and the top edge.

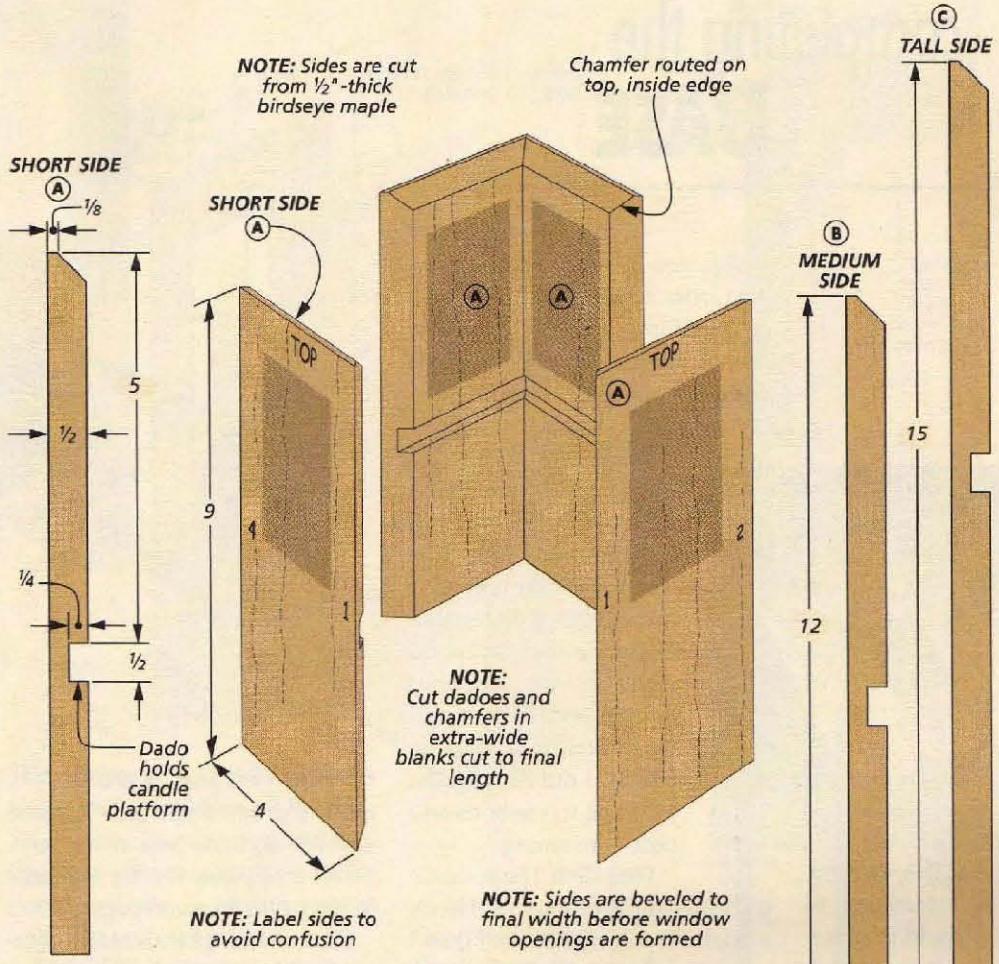
DADOES. In the completed stands, the candle cup is supported by a platform that sits slightly below the windows. This ½"-thick piece is captured in dadoes cut into the four sides. So next, I swapped out the standard blade on the table saw for a ½"-wide dado blade.

The platform is located the same distance (5") from the top edge of each stand. So one setup works for the cuts on all the sides. I set the rip fence as a stop and then made the cuts with the miter gauge, paying close attention to my labels (left How-To drawing below).

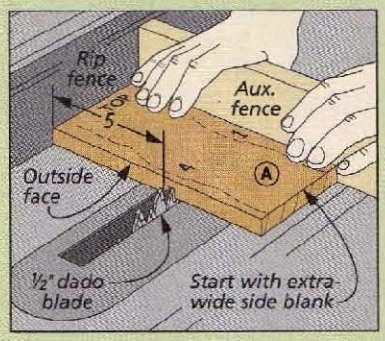
CHAMFERS. Your next stop is at the router table. The top, inside edges of the sides are relieved with a chamfer. To ensure a clean, burn-free cut, I routed the chamfers with multiple shallow passes (middle drawing below).

BEVEL CUTS. With the dadoes and the chamfers completed, you can now bevel the edges of the pieces to form the miter joints. The key is to end up with pieces that are exactly the same width. To accomplish this, I beveled one edge of each piece, then I reset the rip fence and cut all the pieces to finished width. It's pretty simple.

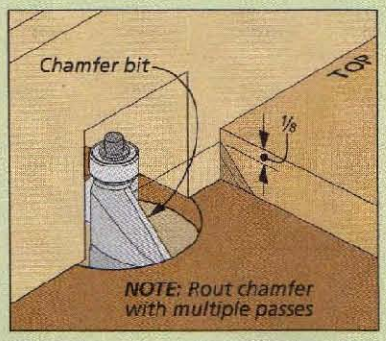
Be sure to make the cuts as shown in the right drawing below, with the blade tilted away from the rip fence. You'll get a cleaner, more accurate cut and the chance of kickback will be minimal.



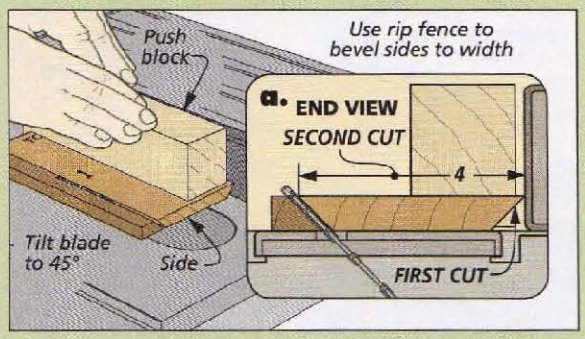
How-To: Make the Base Sides



Dadoes. *I cut all the dadoes in the sides with the same setup, making a single pass across the blade.*

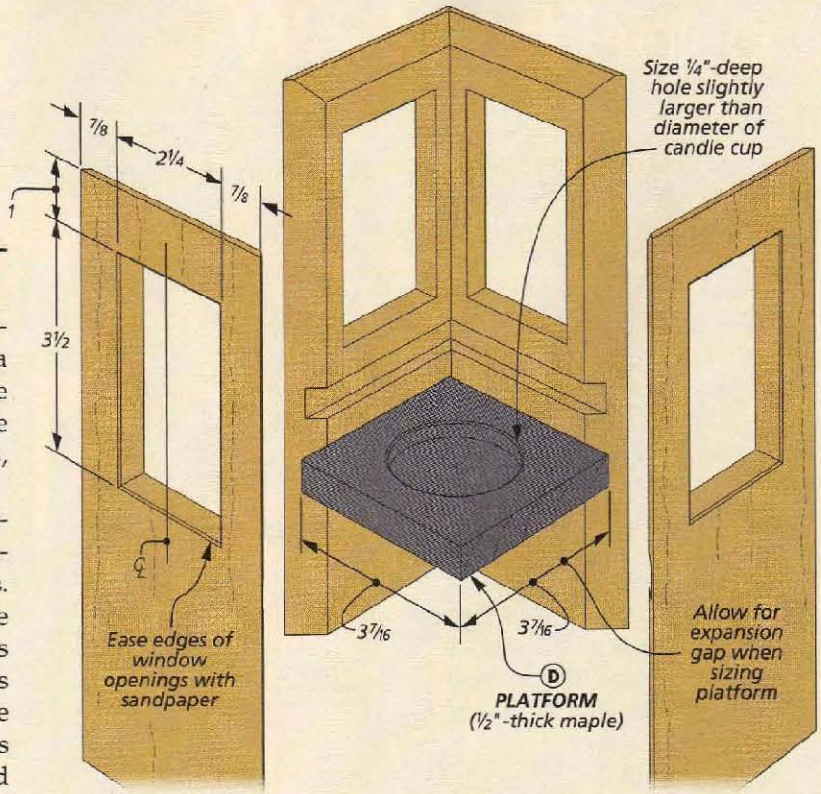


Chamfers. *Double check the labels to make sure you're routing the chamfer on the top, inside edge.*

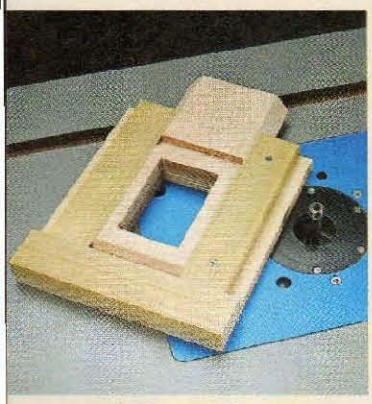


Clean Bevel Cuts. *With the table saw blade tilted to 45°, set the rip fence to bevel the sides to final width. A wide push block will give you better control.*

completing the BASE



Before you can assemble the beveled sides into a base, there are a couple of important details to take care of. First, you'll need to cut the window openings in the sides, then make the candle platforms.



▲ The routing template is held in place by a pair of beveled cleats. You'll find details on building it on page 28.

THREE GOALS. When cutting the window openings, I had three goals. First, I wanted them to be sized consistently. This makes fitting the grilles easier. Second, since the edges of the openings are exposed, they should be smooth and straight. Finally, I didn't want the job to be too tedious and time-consuming.

THREE STEPS. The solution is shown in the box below. Here's a brief overview and then I'll add a few tips. First, I roughed out the openings on the scroll saw. Next, I used a template along with a flush trim bit in the router table to smooth the edges and size the openings. The final step is to clean up the corners with a chisel and small sanding block.

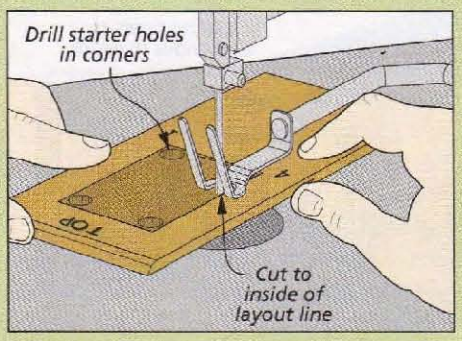
MAKE THE TEMPLATE. Rather than measure and lay out each opening piecemeal, I built the routing template first and then used it to mark the openings. This method is more accurate and saves time. You'll find plans for the template in Shop Notebook on page 28.

Once the template is made, completing the openings just takes a dose of patience. When I roughed them out at the scroll saw, I tried to stay close to the layout line — about 1/32" to 1/16". And I also cut into the drilled-out corners. This saves effort at the router table and later when squaring up the corners.

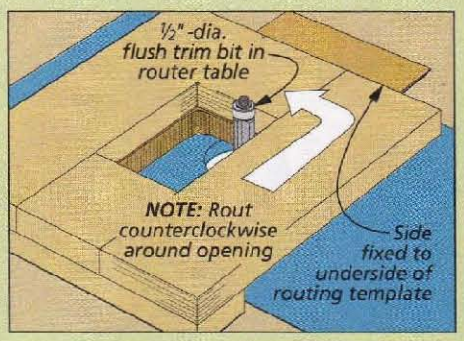
THE PLATFORM. The next step — making the candle cup platform — is sure to go faster. This piece is simply a square of ½"-thick stock with a shallow, 2⅛"-dia. hole in the center, as shown above. I sized the hole slightly larger than the diameter of the candle cup and drilled it with a Forstner bit in the drill press. And then before beginning the assembly of the base, I painted the platform black.

THE ASSEMBLY. The easiest way to get a square, tight assembly is to use band clamps for the glueup. Start with two opposite corners, making sure the top and bottom edges are aligned. Then you can glue the two halves together with the platform "floating" in the dadoes.

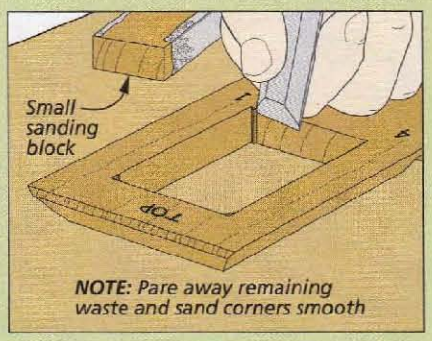
How-To: Make Smooth, Accurate Openings



Rough Openings. *After drilling a starter hole in each corner of the layout, I roughed out the waste with the scroll saw.*



Smooth Openings. *The template fits over the side and allows you to quickly clean up the opening at the router table.*



Square Corners. *To square up the corners, start with a sharp chisel, then switch to a small sanding block.*

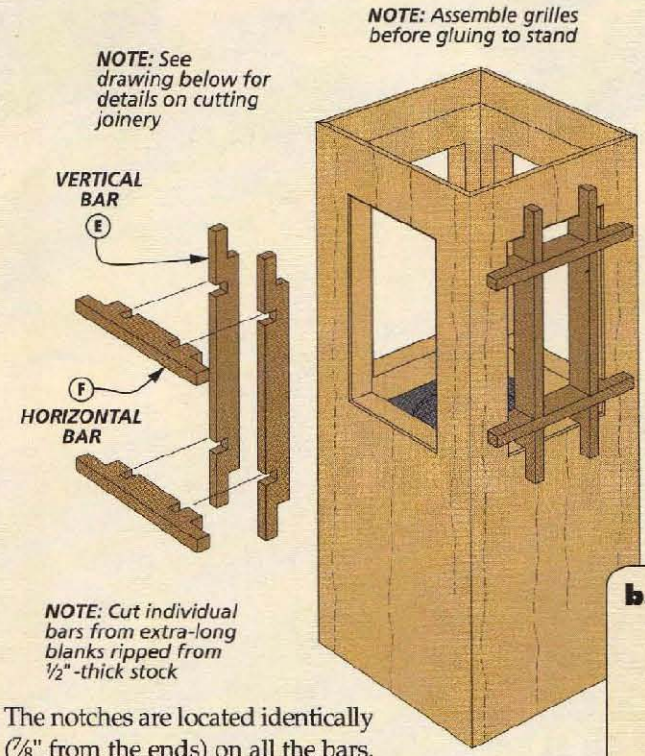
adding the GRILLES

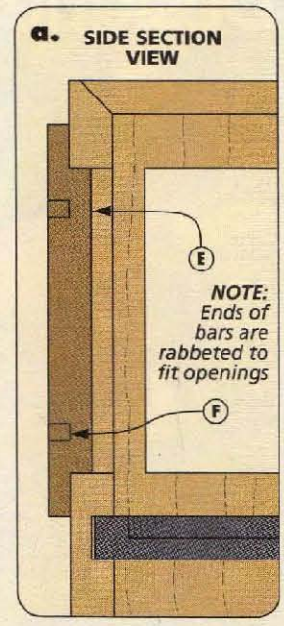
Installing the contrasting grilles in the openings definitely dresses up the appearance of the plain stands. They're not difficult to make. But due to the small size of the pieces, you need to take extra care.

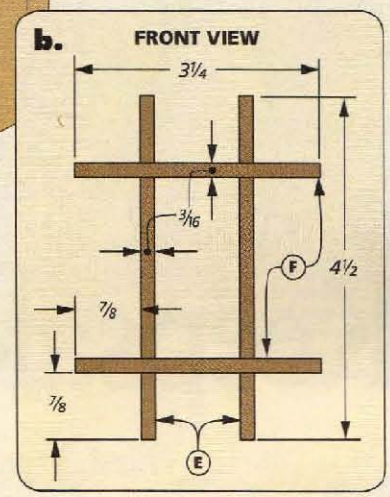
OVERVIEW. The grilles are built using half-lap joints (drawing at right). They're sized to overlap the window openings ½" on each side. The ends of the bars are rabbeted so half the thickness of the grill extends into the window opening, as shown in detail 'a.'

LONG BLANKS. Even though the pieces are small, I decided that the best way to build the grilles was to cut individual bars to final size and then cut the joinery. So first I cut a long blank to width and thickness. Then pieces for the horizontal and vertical bars can be cut to final length (detail 'b'). You'll need eight of each for one stand. But I suggest cutting a few extras for setting up and as insurance. Use a stop on the miter gauge to make certain the pieces are the same length.

THE HALF LAPS. Next come the half-lap joints. The interlocking notches are too narrow to cut with a dado blade, so I used two passes across a standard blade, as shown below.







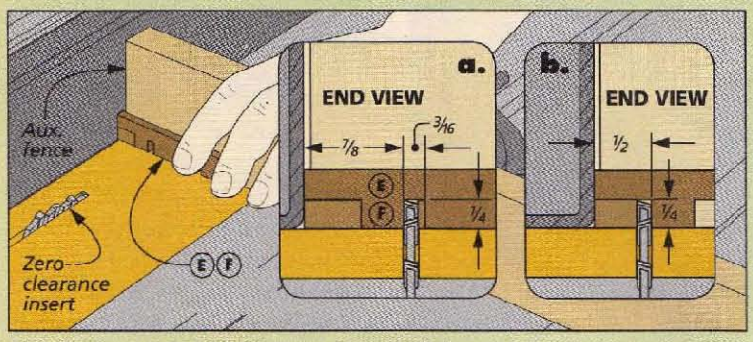
The notches are located identically (⅞" from the ends) on all the bars. So you can use one setup and simply repeat the same cuts on all the bars. Trial cuts on the extra pieces will help with the setup.

END RABBETS. To complete the bars, you need to rabbet the ends. This can also be done with multiple passes across a standard blade, as in detail 'b' below. Just make sure to cut the rabbets on the *inside* edge of all the pieces. I sized the width of the rabbets so the bars would fit easily into the openings.

ASSEMBLE & INSTALL. When assembling the grilles, all it takes is a spot of glue at each joint. Don't forget to check them for square. Finally, finish the job by gluing the grilles into the openings.

After a couple coats of spray lacquer, the candle stands are ready to shine. I'll bet their soft light along with your craftsmanship is sure to draw admiring attention. W

Grille Joinery

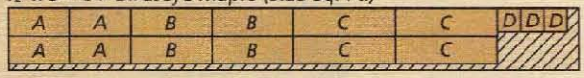


Notches and Rabbets. *I sized the half-lap notches with two passes across a standard blade, moving the rip fence in between. Likewise, use the fence to size the end rabbets for a good fit to the openings.*

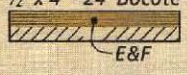
Materials, Supplies & Cutting Diagram

A	Short Sides (4)	½ x 4 - 9
B	Medium Sides (4)	½ x 4 - 12
C	Tall Sides (4)	½ x 4 - 15
D	Platforms (3)	½ x 3 7/16 - 3 7/16
E	Vertical Bars (24)	½ x 3/16 - 4½
F	Horizontal Bars (24)	½ x 3/16 - 3¼

½" x 9" - 84" Birdseye Maple (5.25 Sq. Ft.)



½" x 4" - 24" Bocote (0.66 Sq. Ft.)



NOTE: *Bars are ripped to oversized length and cut to finished dimensions*

a pair of Keepsake Boxes

These imaginative designs not only make wonderful gifts, they're also a great way to build your woodworking skills.

I think of building boxes as a fundamental woodworking skill. After all, the techniques used to build a box are also key to many larger furniture projects. And when you consider the smaller scale of a box and the added scrutiny a small project receives from the viewer, your woodworking skills, and attention to detail, will be put to the test.

▲ The "ribbon" box, named for the handle and inlay on the sides, is made from ash with a handle of lacewood and wenge.

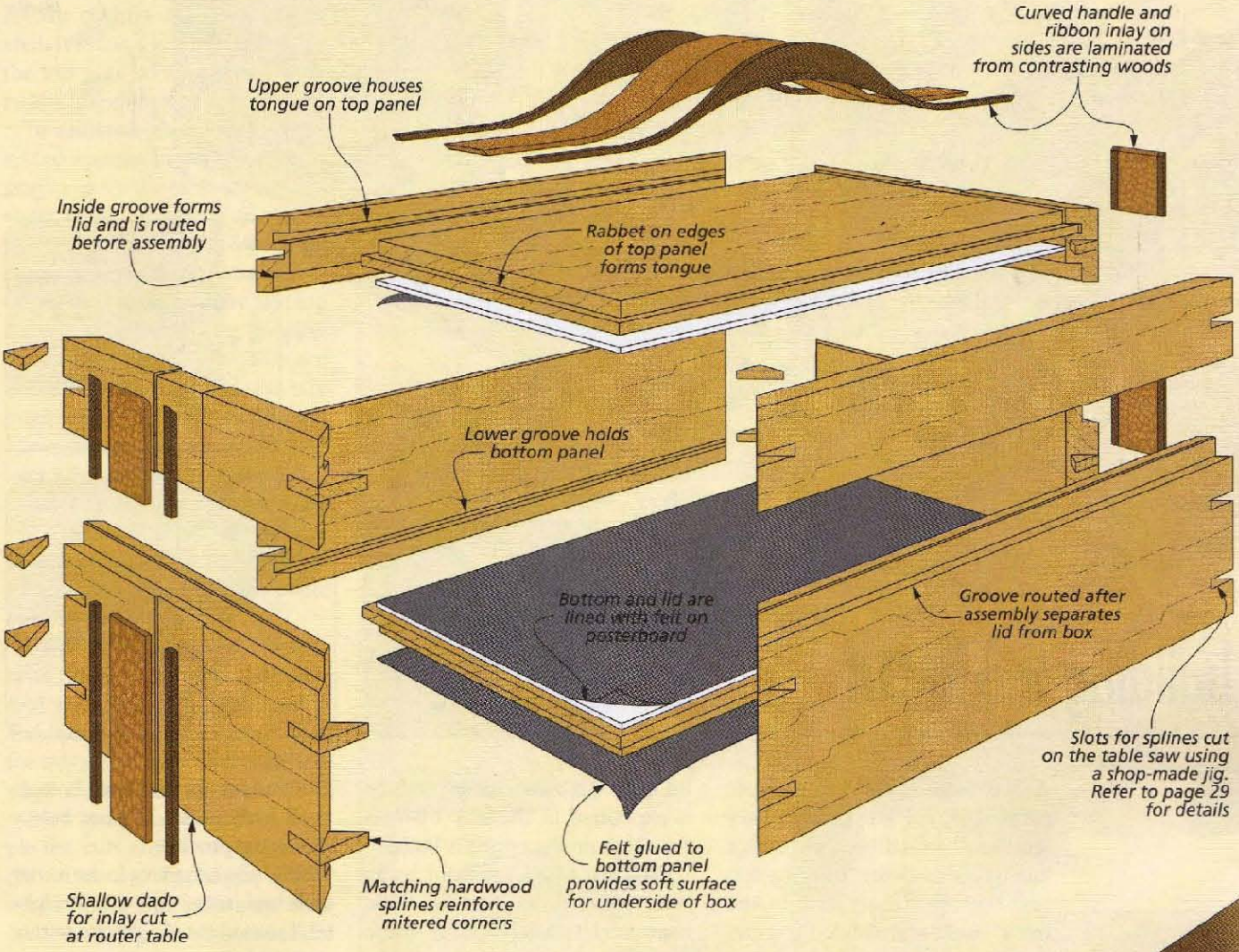
Boxes are also perfect projects for using up small pieces of special or exotic wood. You probably have plenty of these cutoffs left over from larger projects.

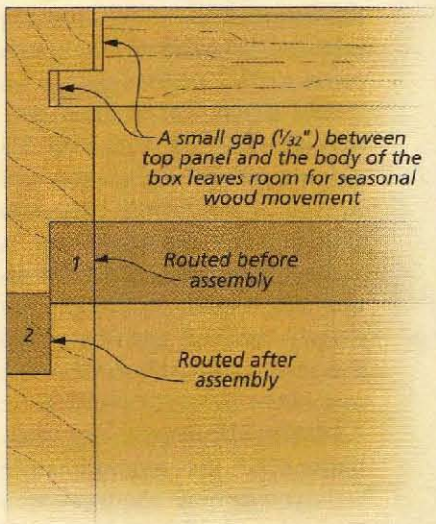
Here are two box designs that are excellent skill builders. In both designs, the basic box is built using splined miters. They also both use the same technique for creating a lipped, fitted lid. The "ribbon" box, shown at left features an interesting inlay and handle. The second box features an imaginative way to use Baltic birch plywood.

These boxes are sure to make great gifts. But you could also use one as the "wrapping" for an even more special present.

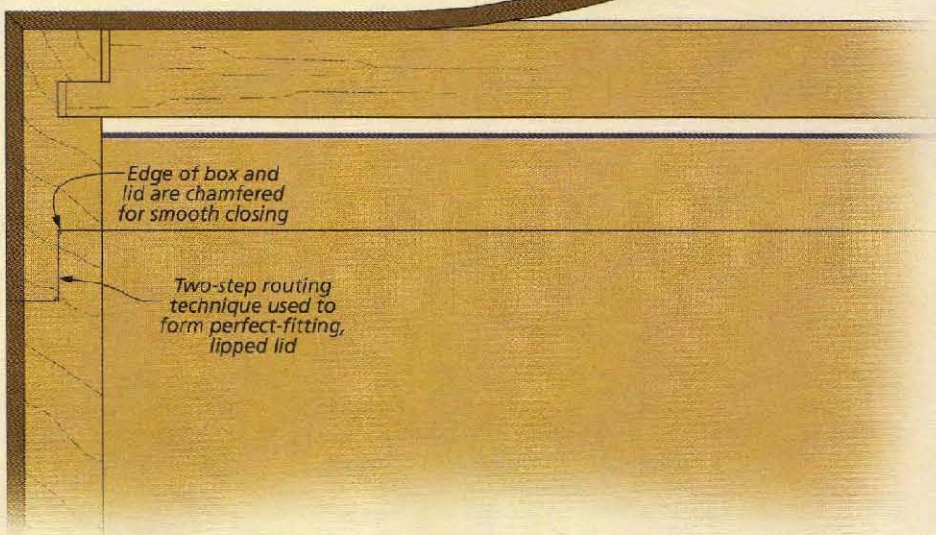
CONSTRUCTION DETAILS

OVERALL DIMENSIONS: 8 13/16"L x 5 1/4"W x 4 1/32"H

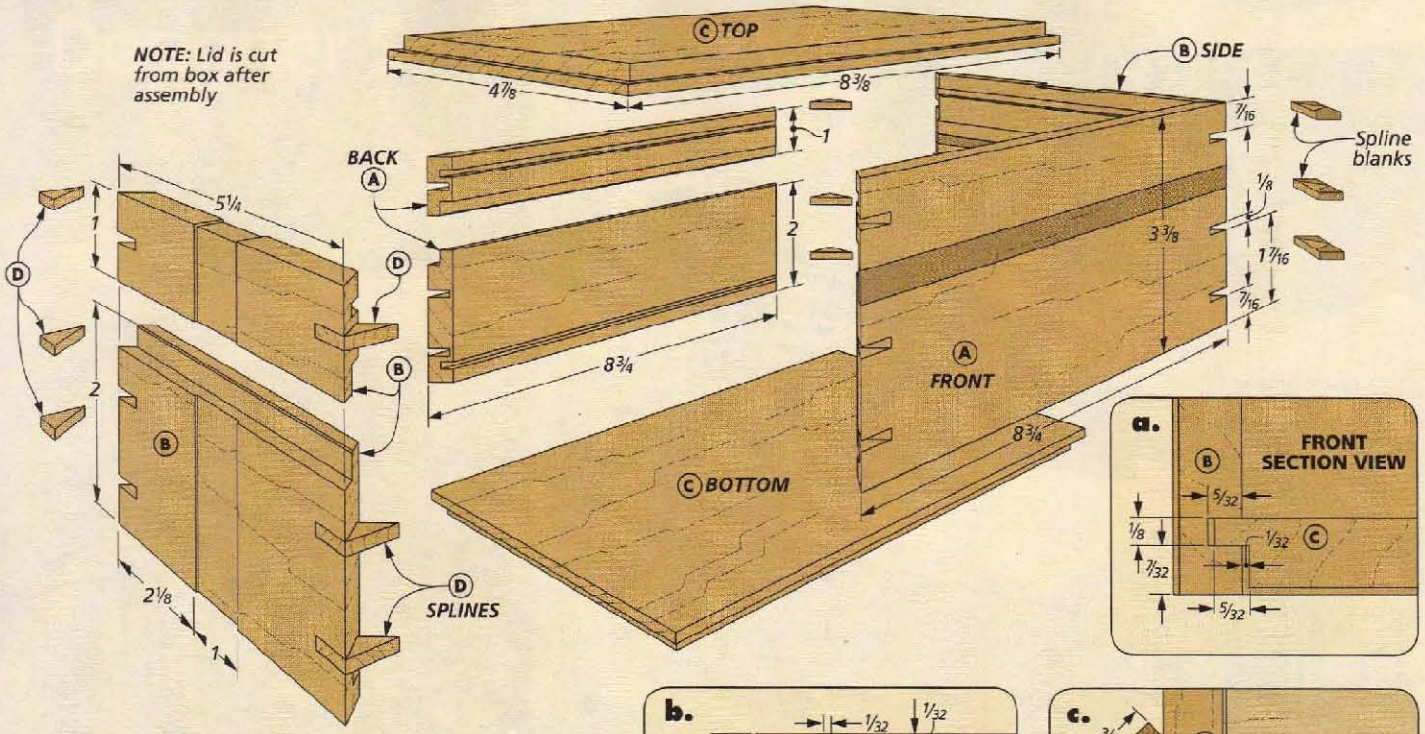




SIDE SECTION VIEW
(before lid separation)



FRONT SECTION VIEW
(after lid separation)



NOTE: Splines are cut from 1/8"-thick hardwood strips. All other parts are made from 5/16"-thick hardwood

building the Box

As I explained earlier, the basic construction of both boxes is very similar. The differences center mostly around the way the top and bottom panels fit into the front, back, and sides. I'll cover the ribbon box first.

For both boxes, a key technique is the method used to separate the lid from the box. This procedure is explained in the step-by-step drawings on the opposite page.

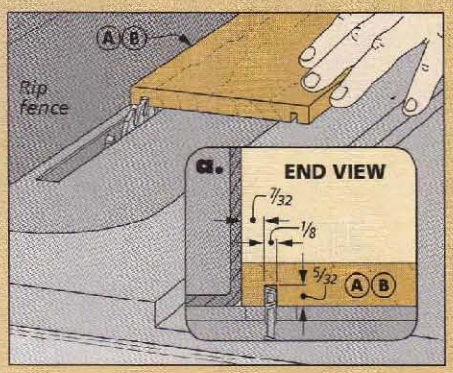
FRONT, BACK & SIDES. The front, back, and sides all require 5/16"-thick hardwood. I started with 1/2"-thick stock and planed it to final thickness. After cutting the pieces to width and rough length, I cut the grooves for the top and bottom in all four pieces. The box below shows the process.

Now you can move to the router table and install a 3/8"-dia. straight bit. I routed the lid groove with a straight bit because it provides a smoother finished cut than a dado blade. Later, you'll rout a groove on the outside of the box to form the mating bottom half. But for now, you can miter all four workpieces to final length.

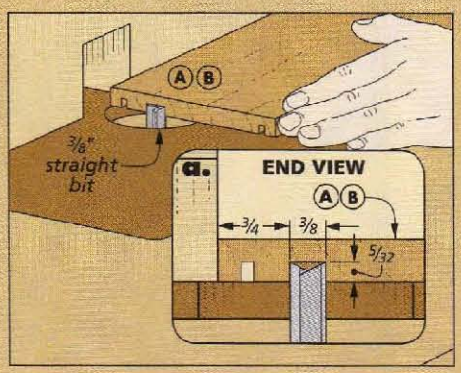
TOP & BOTTOM. The top and bottom are rabbeted to fit into the grooves you cut earlier. You can start by cutting them to final size. Then, cut the rabbets for a snug fit in the grooves. As you test the fit, note that the top and bottom are slightly recessed and that there is a small gap to allow for wood movement (details 'a' and 'b').

ASSEMBLY. The step-by-step illustrations on the opposite page walk you through the process of assembling the box and completing the details. As you can see in Step 1, I taped the miter joints to

How-To: Cut & Rout Grooves



Upper & Lower Grooves. *Cut the grooves for the top and bottom panels using a standard blade in the table saw.*



Inside Lid Groove. *At the router table, install a straight bit and rout the groove that will form the shoulder of the lid.*

keep things in place while I added clamping pressure. A band clamp is perfect for this application, but regular clamps will work fine as well. It's also a good idea to label the top edge of the box so you'll be able to orient it properly later.

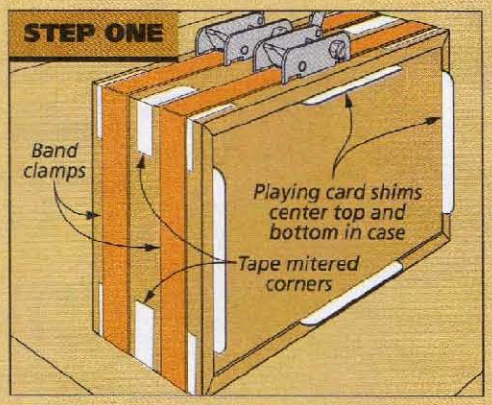
To reinforce the miter joints, I added splines in each corner. A simple jig for the table saw makes short work of cutting the slots. (Refer to Shop Notebook on page 29 for details on the jig.) You can cut the top and bottom slot by flipping the workpiece in the jig, keeping the spacing even. The middle slot is not centered on the sides as you might expect. Instead, it's offset to allow for the groove you'll rout later when you separate the lid.

After gluing the splines in the slots, trim the "ears" off the ends. A flush-cut saw is the ideal tool for this task (Step 4). Then plane or sand the surface smooth.

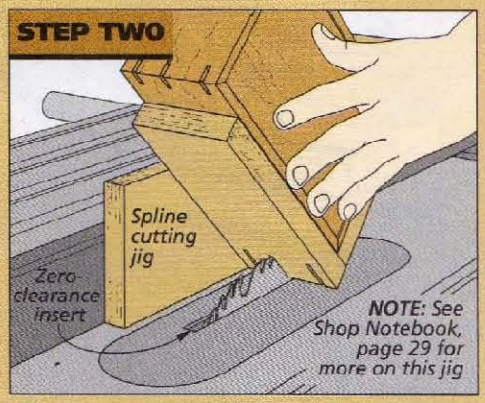
ROUT THE CHANNEL. Now it's time to head over to the router table and rout the channel for the handle and inlays (Step 5). I started with the sides first, then routed the top edge of the sides.

It's a good idea to make a couple test cuts with a straight bit to dial in the 1/32" bit height. Then, set the fence and make your first cut. Next, flip the box side-for-side and make another cut. This technique will ensure the channel is centered on the box. Move the fence and rout away the remaining waste until you've cut a 1"-wide channel in both sides, including the top edges of the sides.

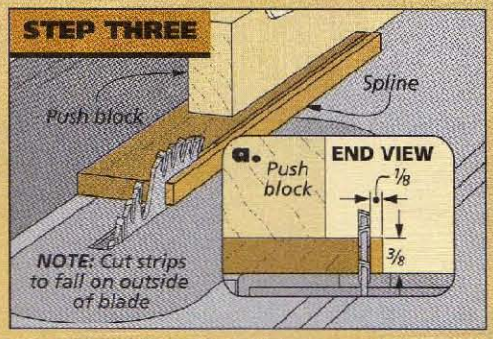
SEPARATING THE LID. At this point, you're ready to rout the groove that will separate the lid. As you can see in Step 6, you'll need to set the bit just a hair below final depth to avoid cutting all the way through. Then, simply place the top against the fence to rout all four sides. This technique will leave the lid attached to the box while you complete the cut. I used a utility knife to cut through the thin membrane and separate the lid (Step 7). Finally, use a sanding block to fine-tune the fit of the lid, as shown in Step 8.



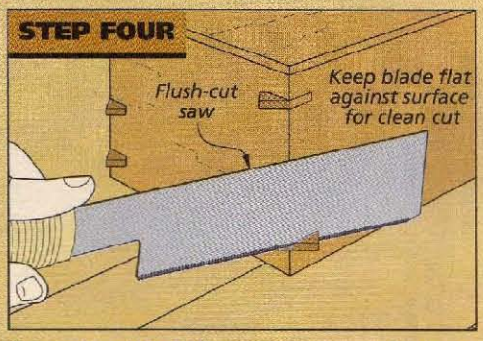
Assembly. *Assemble the miter joints with glue, tape, and band clamps. Cut strips of playing cards to use as shims to maintain an even gap.*



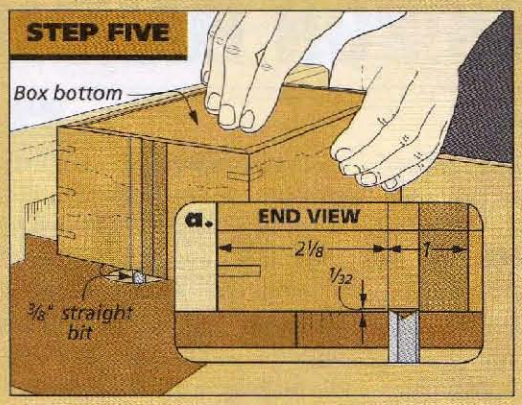
Slots for Splines. *I used a simple, shop-made jig to hold the box at a 45° angle while cutting the slots for the splines.*



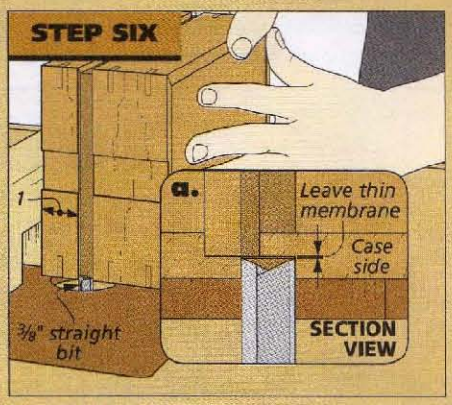
Ripping Thin Strips. *Using a push block to safely hold the blank, rip several 1/8"-thick strips to use for splines.*



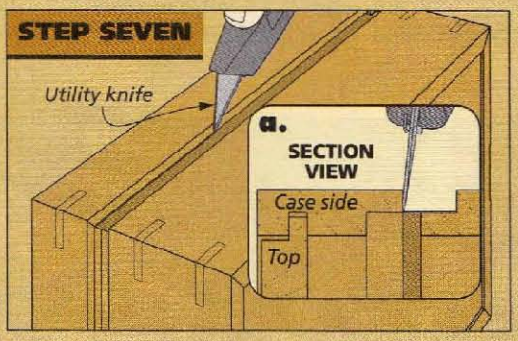
Trimming the Splines. *A Japanese flush-cut saw works great for trimming the waste from the splines. Then plane or sand the surface.*



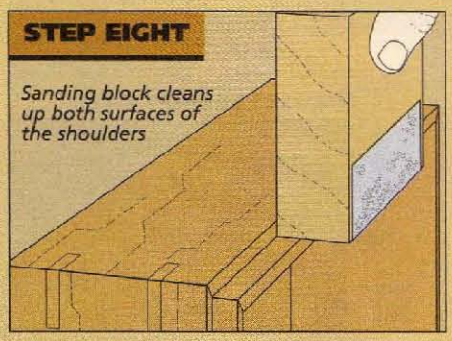
Routing the Channel. *Rout the channel for the inlay on the sides first, then rout the top edge of the sides to hold the end of the handle.*



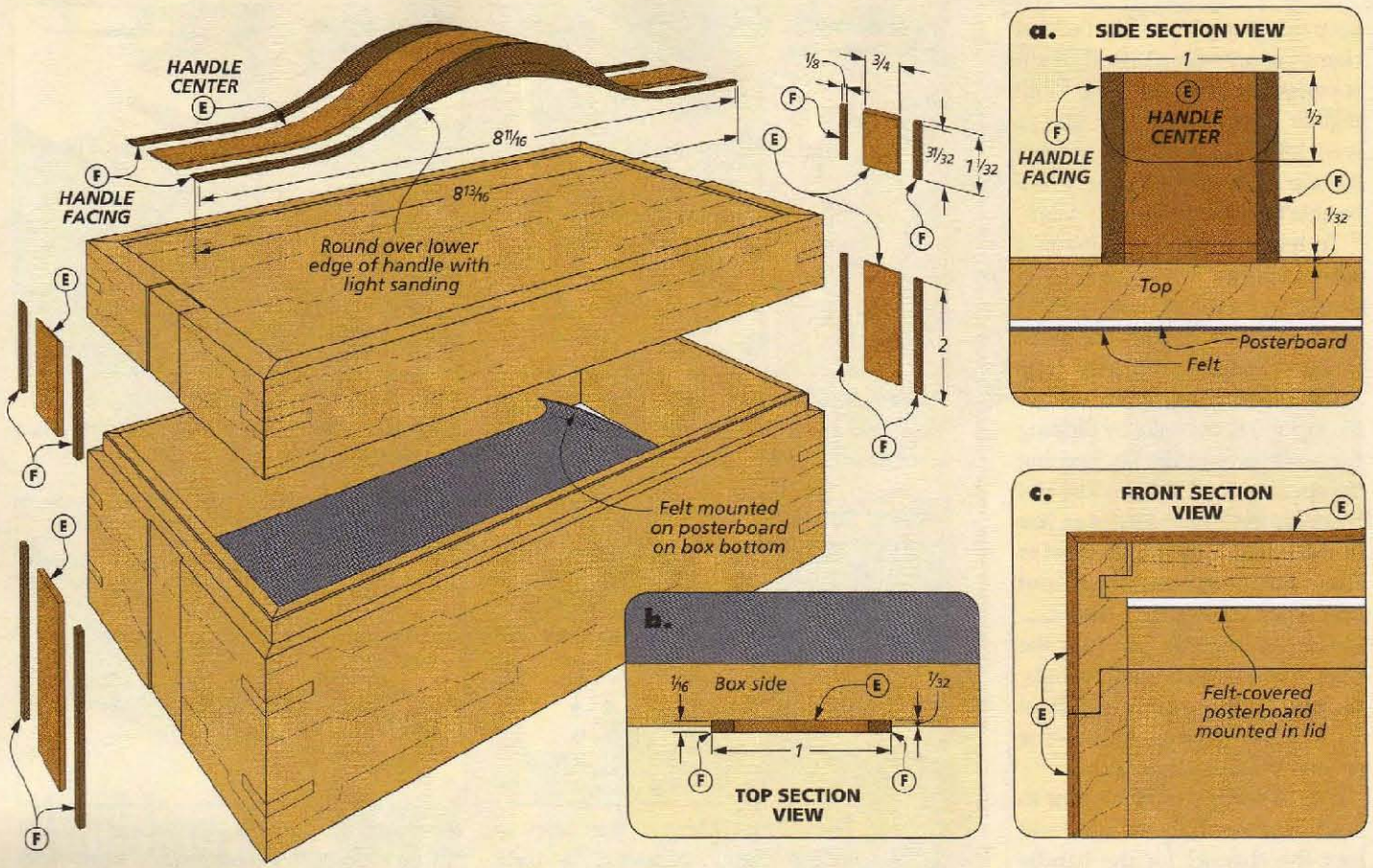
Separating the Lid. *To separate the lid, set the router bit height just a hair lower than half the stock thickness.*



Final Trim. *There should be a very thin strip remaining after routing the groove. Simply cut through it with a utility knife.*



Sanding. *Wrap a piece of 220-grit sandpaper over a square-sided block to clean up the shoulders for a good fit.*



adding the RIBBON HANDLE

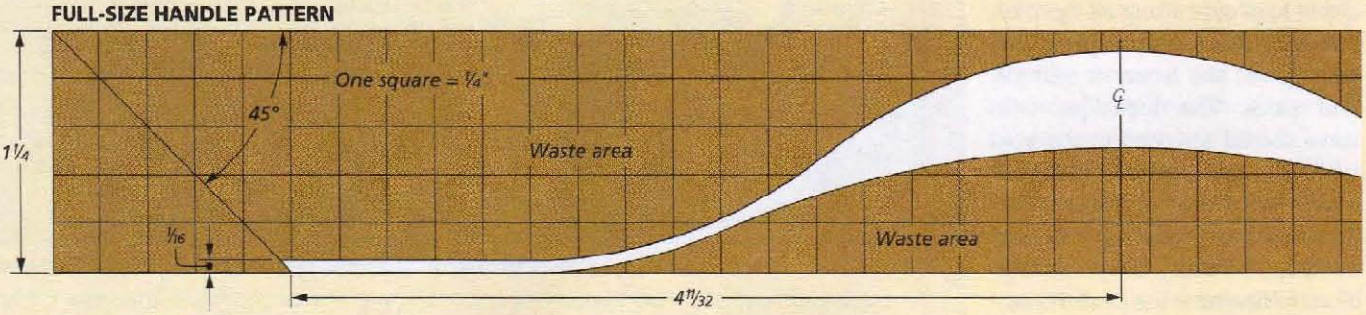
With the basic box assembled and sanded, it's time to turn your attention to the handle. For this box, I made a "ribbon" handle that runs across the top with a matching inlay going down both sides. As you can see in the main drawing above, the handle is a lamination of two different hardwoods.

While the handle is glued directly to the top, the ends of the handle and the side ribbons fit into the channel on the sides. The thin strips that run down the sides might look difficult to laminate, but don't worry, you'll cut all the pieces from a single, larger laminated blank.

GLUE UP THE LAMINATED BLANK. The lacewood and wenge combined with the gentle curve in the handle really give the box a distinctive look. You may want to experiment with different woods from your own scrap pile to find a combination that complements the stock you used for the box. You'll need a ¾"-thick piece for the center and two ⅛"-thick pieces for the facing. Just keep in mind that the thickness of the finished blank needs to match the channel you routed earlier. It's a good idea to glue up an oversized blank (about 16" long) so you can trim it to final size after cleaning up the glue squeezeout.

I started by cutting the handle pieces to size. Then I glued them together, adding a piece of tape along one edge. The tape helps

FULL-SIZE HANDLE PATTERN



prevent the pieces from shifting under clamping pressure. Another benefit is that it forces most of the glue to squeeze out on the opposite edge. That makes cleaning it up much easier. It's also a good idea to use a caul on both sides of the blank when you add the clamps.

CUTTING THE HANDLE. Once the glue has dried, you'll need to clean up the laminated blank. You can use a block plane to smooth the edge you taped earlier (Figure 1). Then head to the table saw and trim the opposite edge square and parallel.

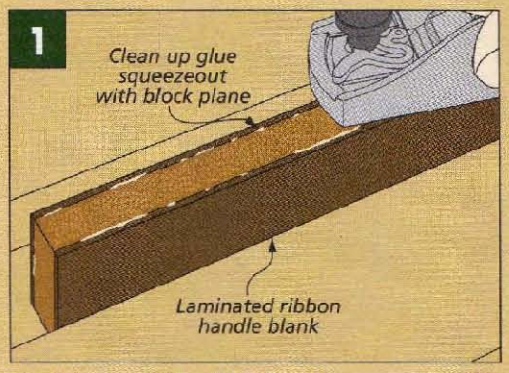
Next, make a copy of the pattern on the opposite page and attach it to the blank with spray adhesive. The pattern makes it easy to cut the blank to shape and position the miter cuts on each end. I cut the miters first to guarantee a good fit for the joints where the handle will meet the side strips. It would be very difficult to accurately miter the thin pieces separately.

Once you've mitered the ends, use the pattern to cut out the shape of the handle. I cut it out at the band saw and cleaned up the surfaces using a sanding drum (Figures 3 and 4). I also rounded over the sharp edges by hand sanding to provide a more comfortable grip.

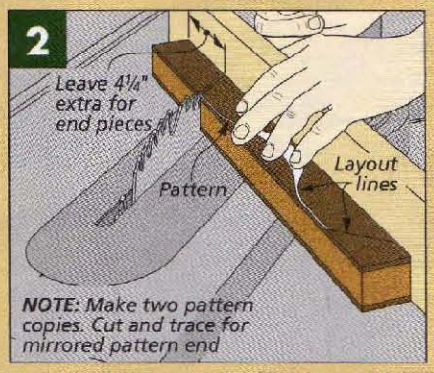
The cutoff from the handle blank is used to make the side ribbons. Figure 5 shows how you can get all four pieces from the blank, using the mitered ends to mate with the handle. After cutting them out, you'll need to sand or scrape them to remove the saw marks and then cut them to final length.

All that remains to complete the box is to glue the pieces in place (Figure 6) and then install the felt-covered posterboard lining.

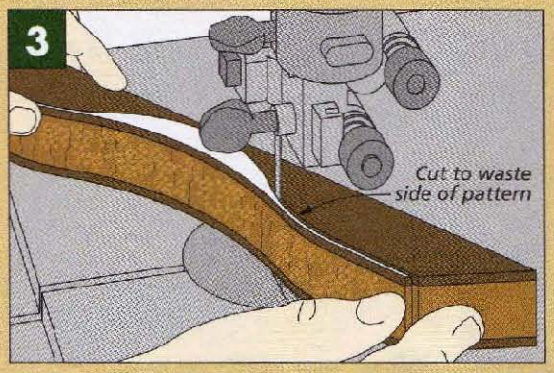
How-To: Make the Laminated Handle



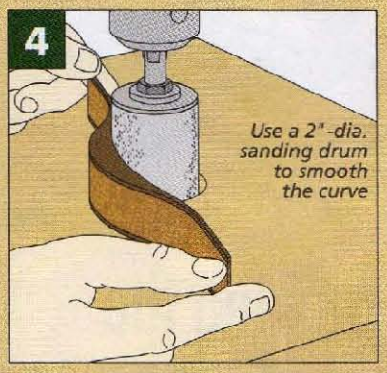
Cleaning up the Blank. *After removing the tape from the edge of the blank, a couple passes with a block plane will clean up the edge.*



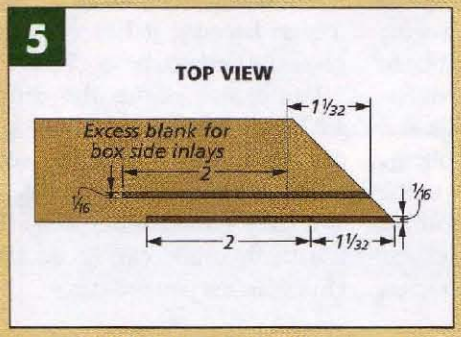
Cut the Miters. *With the pattern glued to the blank, you can easily line up the miter cuts on each end.*



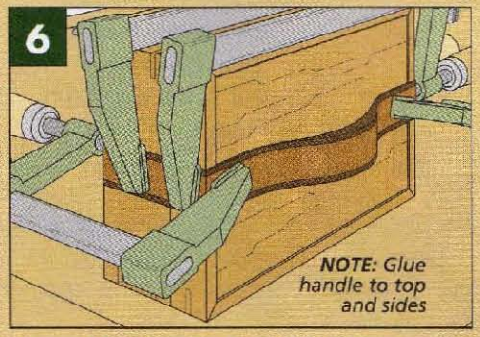
Cutting the Curved Handle. *Cut the handle to rough shape at the band saw, making sure to keep the cut on the waste side of the layout line.*



Drum Sanding. *A sanding drum makes short work of smoothing the saw marks and shaping the handle.*



Cutting Side Inlays. *Using the excess from the laminated blank, rip the thin strips for the side inlays at the band saw.*



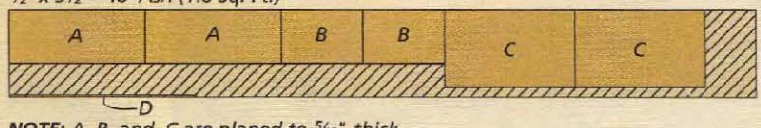
Assembly. *Since the inlays fit in the channel you routed earlier, assembly is just a matter of adding glue and gentle clamping pressure.*

Materials, Supplies & Cutting Diagram

A	Front/Back (2)	5/16 x 3 3/8 - 8 3/4
B	Sides (2)	5/16 x 3 3/8 - 5 1/4
C	Top/Bottom (2)	5/16 x 4 7/8 - 8 3/8
D	Splines (12)	1/8 x 3/8 - 1
E	Handle Blank Center (1)	3/4 x 1 1/4 - 16 rgh.
F	Handle Blank Facing (2)	1/8 x 1 1/4 - 16 rgh.

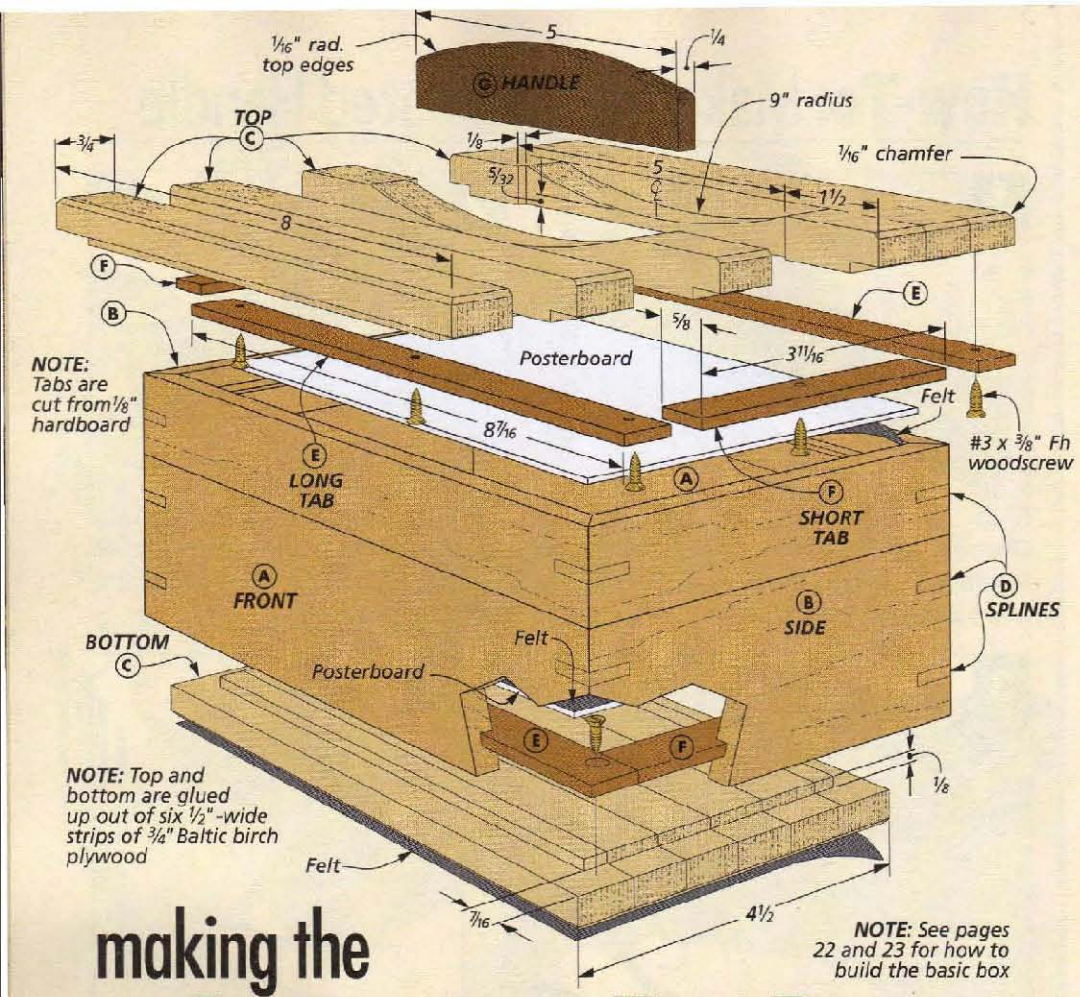
- (2) Posterboard Backing (Cut to Fit)
- (3) Black Felt (Cut to Fit)

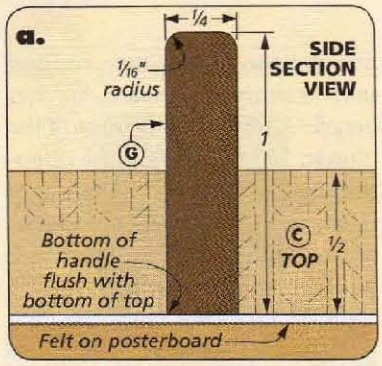
½" x 5½" - 48" Ash (1.8 Sq. Ft.)

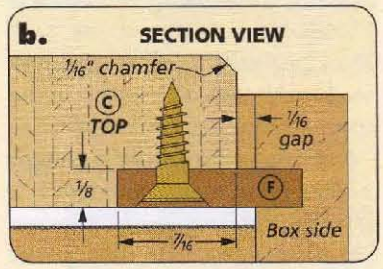


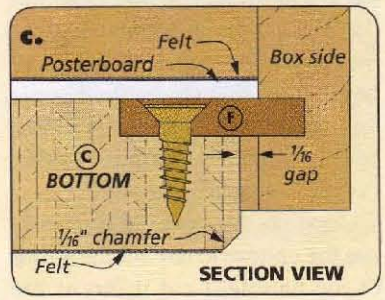
NOTE: *A, B, and, C are planed to 5/16" thick*

Also needed: Stock for handle blank (parts E & F)









making the LAMINATED-TOP BOX

Although it's quite different in appearance, the construction of the laminated-top box is very similar to that of the ribbon box. The differences are all in the materials and installation of the top and bottom.

The unusual, striped look of the top and bottom comes from cutting strips of Baltic birch plywood and laminating them together on edge. Baltic birch works well for this design because it has very thin plies and few voids.

You'll also notice the different handle on this box. The top is dished out and a contrasting wood handle is inserted into a slot (detail 'a' above). While it looks tricky, this is actually pretty easy to do after gluing up the laminations.

The last major difference is the way the top and bottom panels are attached to the box. I used tabs made from 1/8" hardboard to make the connection. Details 'b' and 'c' show you how this works.

START WITH THE BOX. You can refer back to page 22 to get started on the box. The only difference is that the sides of the box are glued up without the top and bottom in place. So it's a good idea to take extra care

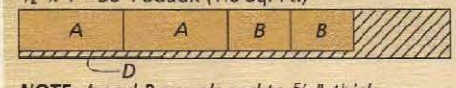
▼ This design incorporates padauk, Baltic birch plywood, and wenge.

Materials, Supplies & Cutting Diagram

A	Front/Back (2)	5/16 x 3 3/8 - 8 3/4
B	Sides (2)	5/16 x 3 3/8 - 5 1/4
C	Top/Bottom (2)	1/2 - 4 1/2 x 8*
D	Spline Blank (1)	1/8 x 3/8 - 12 rgh.
E	Long Tabs (2)	1/8 hdbd. - 5/8 x 8 7/16
F	Short Tabs (2)	1/8 hdbd. - 5/8 x 3 11/16
G	Handle (1)	1/4 x 1 - 5

- (16) #3 x 3/8" Brass Fh Woodscrews
- (2) Posterboard Backing (Cut to Fit)
- (3) Black Felt (Cut to Fit)

1/2" x 4" - 36" Padauk (1.0 Sq. Ft.)



***NOTE:** A and B are planed to 5/16" thick*

**Also needed: One 12" x 12" sheet of 3/4" Baltic birch plywood; One 12" x 12" sheet of 1/8" hardboard; one 1/4" - 1" x 5" wenge blank*

to keep things square, since the top and bottom aren't there to provide any additional support.

TOP AND BOTTOM LAMINATIONS. After assembling the box, you can move on to laminating the top and bottom panels. The bottom is simply laminated and then sanded smooth. Just cut six ½"-wide strips of ¾" Baltic birch and glue them together on edge. This is a little like gluing up a tabletop on a smaller scale.

You'll need to do a little more work on the top. Once again, start with six strips of plywood. Then take the two middle strips to the band saw and cut the shallow curve in both pieces (Figure 1). A quick touch-up on a sanding drum smooths the curved surfaces.

Now you can glue up three strips to form each half of the top. Just be sure to keep the dished out pieces on the edge. Then take both halves to the table saw and install a dado blade. Using a miter gauge, cut the ⅛"-deep notch in each piece as shown in Figure 3. This forms the mortise for the handle. After completing the cuts, go ahead and glue up the two halves.

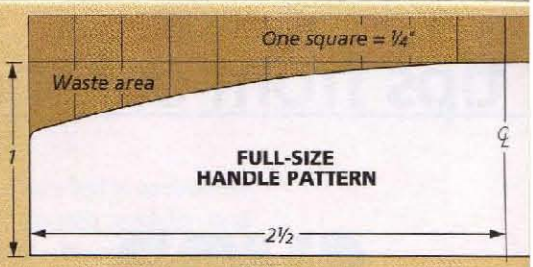
RABBETS. There are just a couple more things to do to complete the top and bottom. First, rout a rabbet around the inside face of both pieces. This rabbet fits over the hardboard tabs in the box.

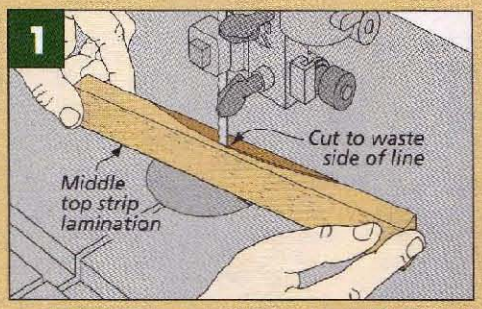
Next, rout the chamfer on both pieces (Figure 5). Now you can install the hardboard tabs and attach the top and bottom with screws. I countersunk the screw holes for a flush fit (Figure 6).

ADD THE HANDLE. At this point you're ready to work on the handle. Start by planing a blank for a tight fit in the lid slot. Then use the pattern at the upper right to lay out the shape of the handle and cut it out at the band saw. I also eased the top edges with a light sanding. Finally, just add a little glue in the slot and install the handle. Once again, I added a lining of felt on posterboard in the box.

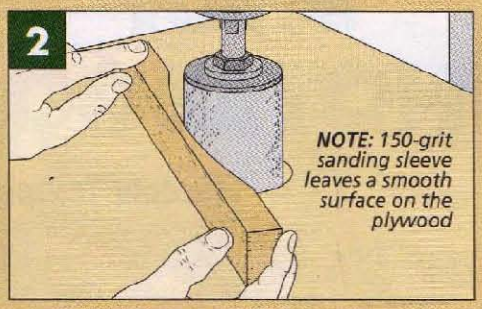
These designs represent a couple of different ways to build an attractive box. Best of all, the techniques can be used for decorative boxes of all shapes and sizes. W

How-To: Make the Top & Bottom

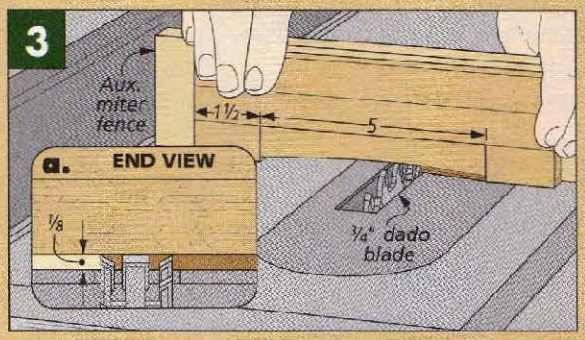




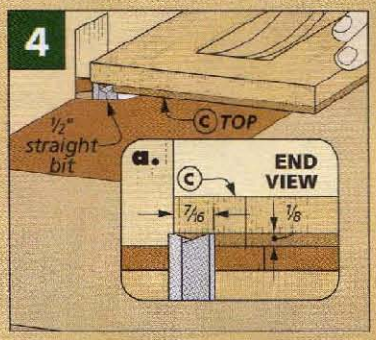
Cutting the Curved Recess. *At the band saw, cut the curve that forms the dished out recess for the handle.*



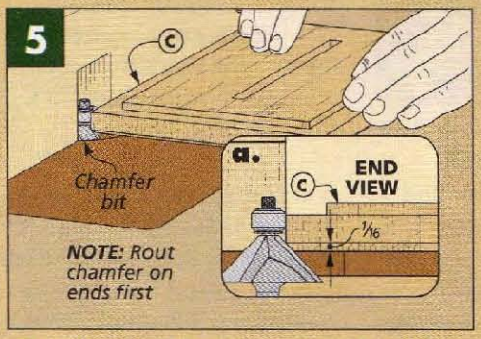
Drum Sanding. *A sanding drum guarantees a very smooth surface for the curve in the edge grain of the plywood.*



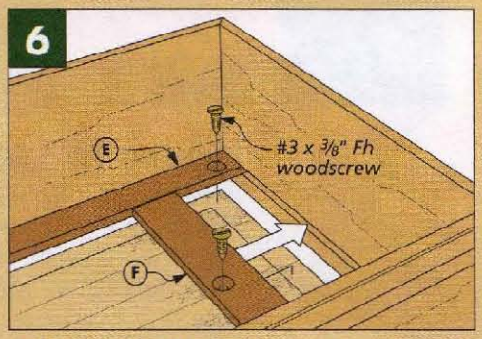
Cutting the Notch. *With an auxiliary fence on the miter gauge, use a dado blade to cut the shallow notches that will house the handle.*



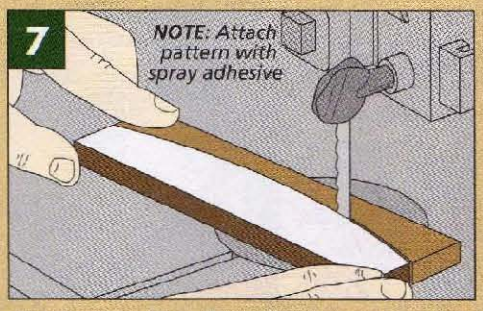
Routing Rabbet. *After gluing up the top, rout a rabbet on all four edges to fit over the tabs.*



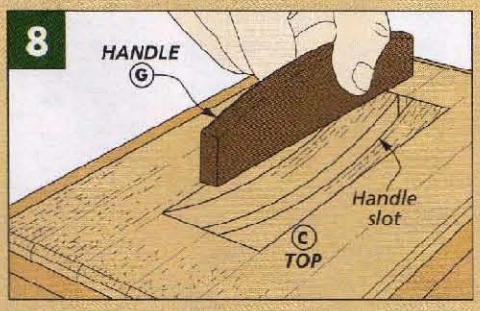
Chamfer the Edges. *Routing a chamfer not only eases the top edges, but also provides an attractive, decorative detail.*



Attaching the Top & Bottom. *Drill countersunk screw holes in the tabs before installing them in the grooves in the box.*



Cutting the Handle. *With the pattern glued to the blank, cut out the handle, making sure to cut to the waste side of the line.*



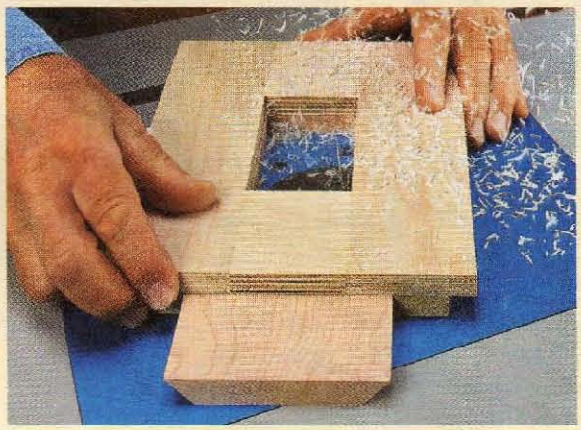
Installing the Handle. *After sanding the handle smooth and rounding over the top edges, simply glue it into the slot.*

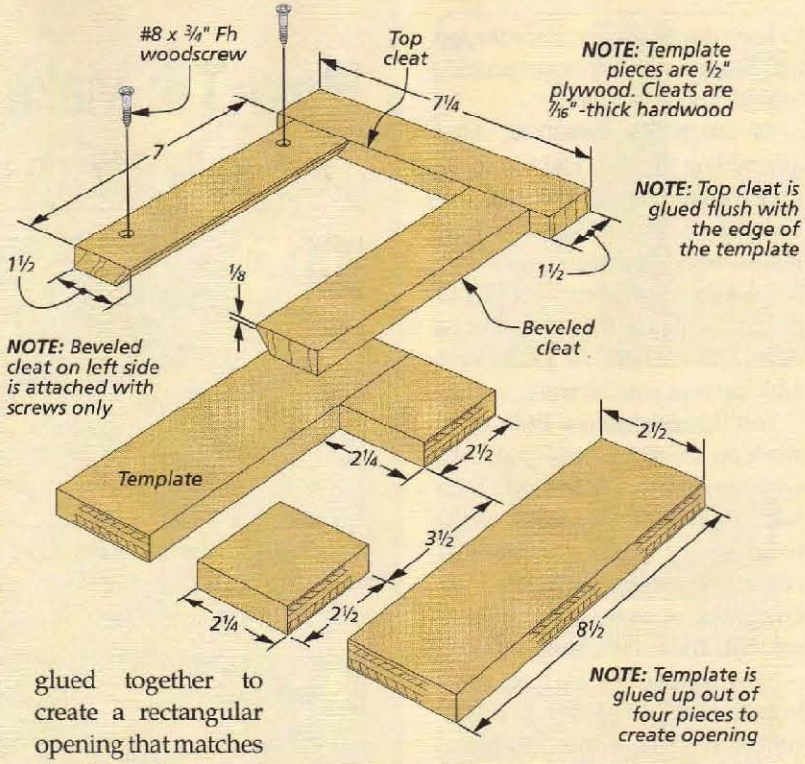
SHOP NOTEBOOK

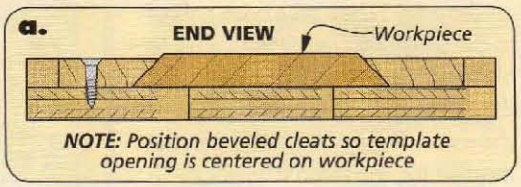
Window Template

To create the "windows" in the sides of the candle stand on page 16, I used a flush trim bit and a template (photo below). The template and router bit combination leave the opening with perfectly smooth, clean edges.

TEMPLATE. The template is made out of four pieces of ½" plywood (see drawing above). These are glued together to create a rectangular opening that matches the finished size of the window.







To position the template on the workpiece, I added some hardwood cleats. I made these slightly thinner than the sides of the candle stand so they won't stand proud of the workpiece while routing the opening. The side cleats are also beveled to capture the workpiece and hold it tightly in place (detail 'a').

The top cleat and one of the side cleats are glued to the template to accurately position the opening on the workpiece. By using screws to attach the other side cleat, you can loosen it in order to insert and remove each side of the stand.

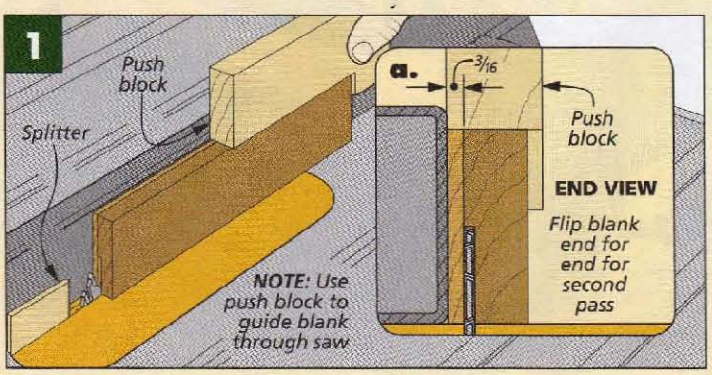
Planing Thin Stock

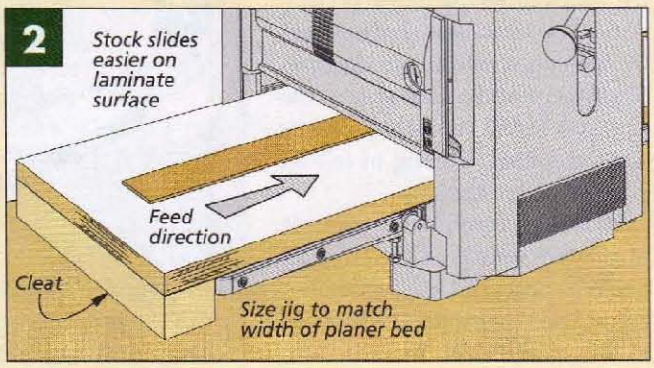
If you have a table saw and a planer, resawing lumber into thinner stock is pretty straightforward. But both the ribbon box on page 20 and the bookcase on page 30 require parts that are cut from *very* thin stock (⅛" or less). And many planers aren't designed to handle stock this thin.

Fortunately, there's an easy solution to this dilemma. I start by resawing the lumber to a thickness of about 3/16" on the table saw. As you can see if Figure 1, a notched push block will guide the blank safely past the blade.

To safely plane the workpiece to the desired thickness, I added an auxiliary bed to my planer. As shown in Figure 2, this is simply a piece of plywood covered with plastic laminate. A cleat on the end hooks over the planer bed.

The auxiliary bed supports the workpiece as it passes through the planer and raises it high enough to contact the planer knives.





Stopped Roundovers

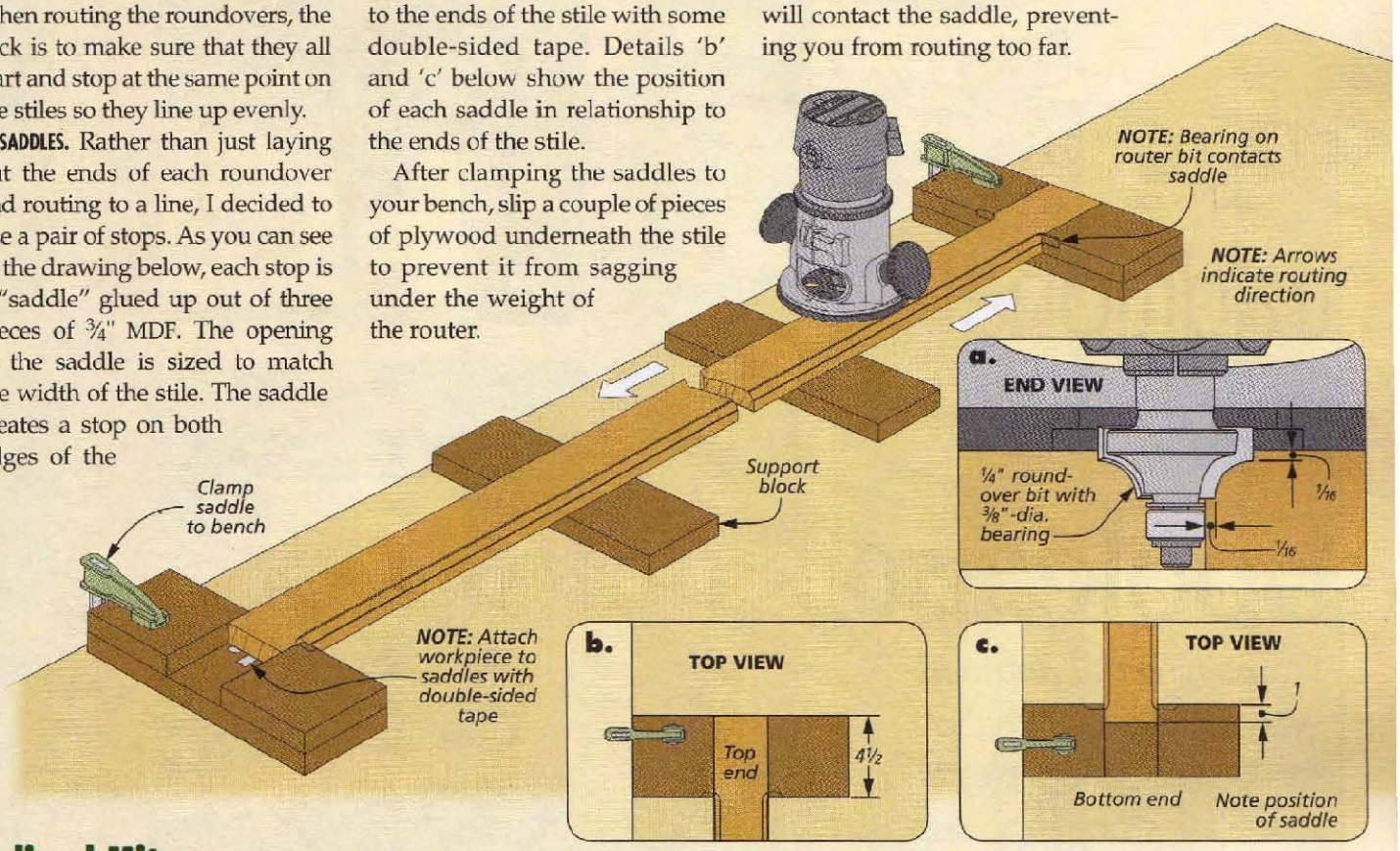
One of the features of the bookcase on page 30 is the stopped roundovers on the face frame stiles. When routing the roundovers, the trick is to make sure that they all start and stop at the same point on the stiles so they line up evenly.

SADDLES. Rather than just laying out the ends of each roundover and routing to a line, I decided to use a pair of stops. As you can see in the drawing below, each stop is a "saddle" glued up out of three pieces of ¾" MDF. The opening in the saddle is sized to match the width of the stile. The saddle creates a stop on both edges of the stile, so both roundovers start and stop at the same point.

To use the saddles, attach them to the ends of the stile with some double-sided tape. Details 'b' and 'c' below show the position of each saddle in relationship to the ends of the stile.

After clamping the saddles to your bench, slip a couple of pieces of plywood underneath the stile to prevent it from sagging under the weight of the router.

Now all that's left is to rout the roundovers. As you reach the end of the pass, the bearing of the bit will contact the saddle, preventing you from routing too far.

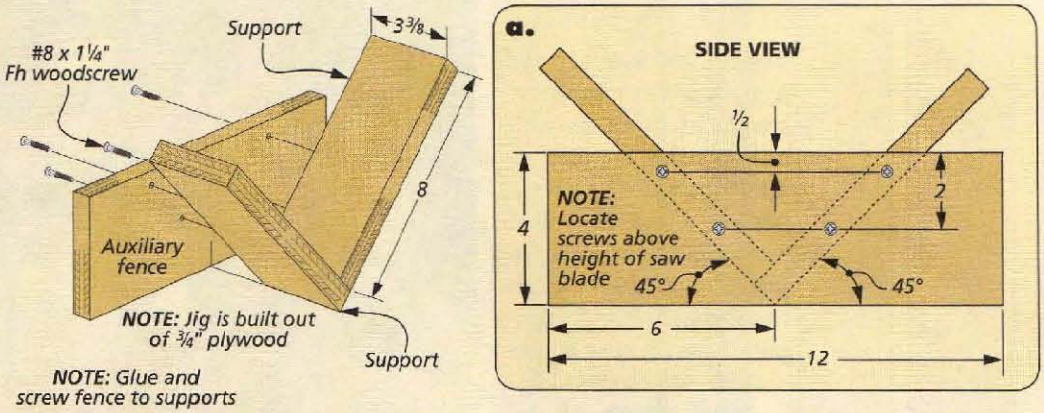


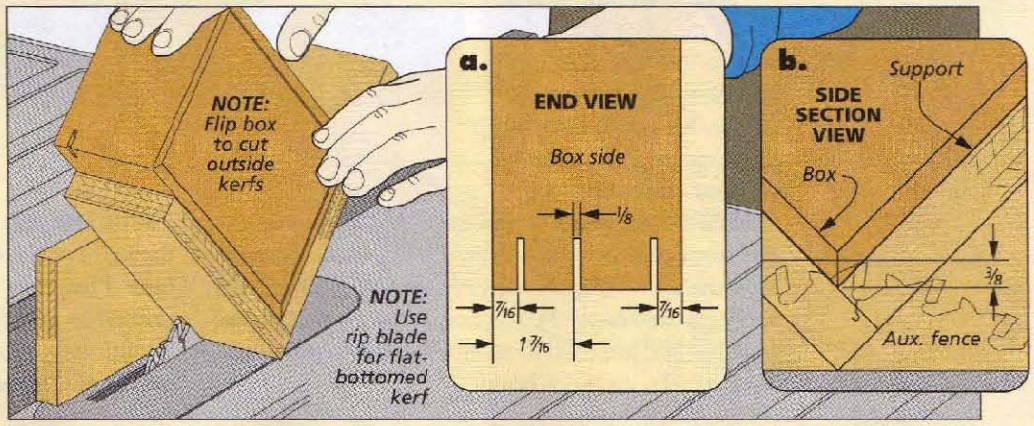
Splined Miters

The keepsake boxes on page 20 are both assembled with miter joints. To strengthen these joints, I added splines. The splines create additional gluing surface and help prevent the miter joints from opening up over time.

The hardwood splines are glued into kerfs cut across the miter joints. Fortunately, these can be cut easily on the table saw using a simple jig like the one shown at right. The jig is nothing more than an auxiliary fence with a couple of supports that cradle the box at a 45° angle as you cut the kerfs.

The jig simply rides against the rip fence of your table saw, as shown in the drawing at right. This way, you can use the rip fence to position the kerfs on the box. You can cut the two outside kerfs using the same rip fence setup simply by flipping the box between cuts. To cut the middle kerf, you'll have to reposition the fence.





traditional oak Bookcase

Combining classic details with simple construction, this project offers plenty of space for storage or display.

Bookcases are always a great place to display treasured items as well as books. But building an attractive, stylish bookcase often involves complicated joinery and complex molding. Although this design has all the appeal, I've simplified the construction to make it easier to build.

DETAILS. Plinth blocks, dentil molding, and other details ensure that you have a quality piece of furniture. So you'll have no shortage of compliments on your craftsmanship.

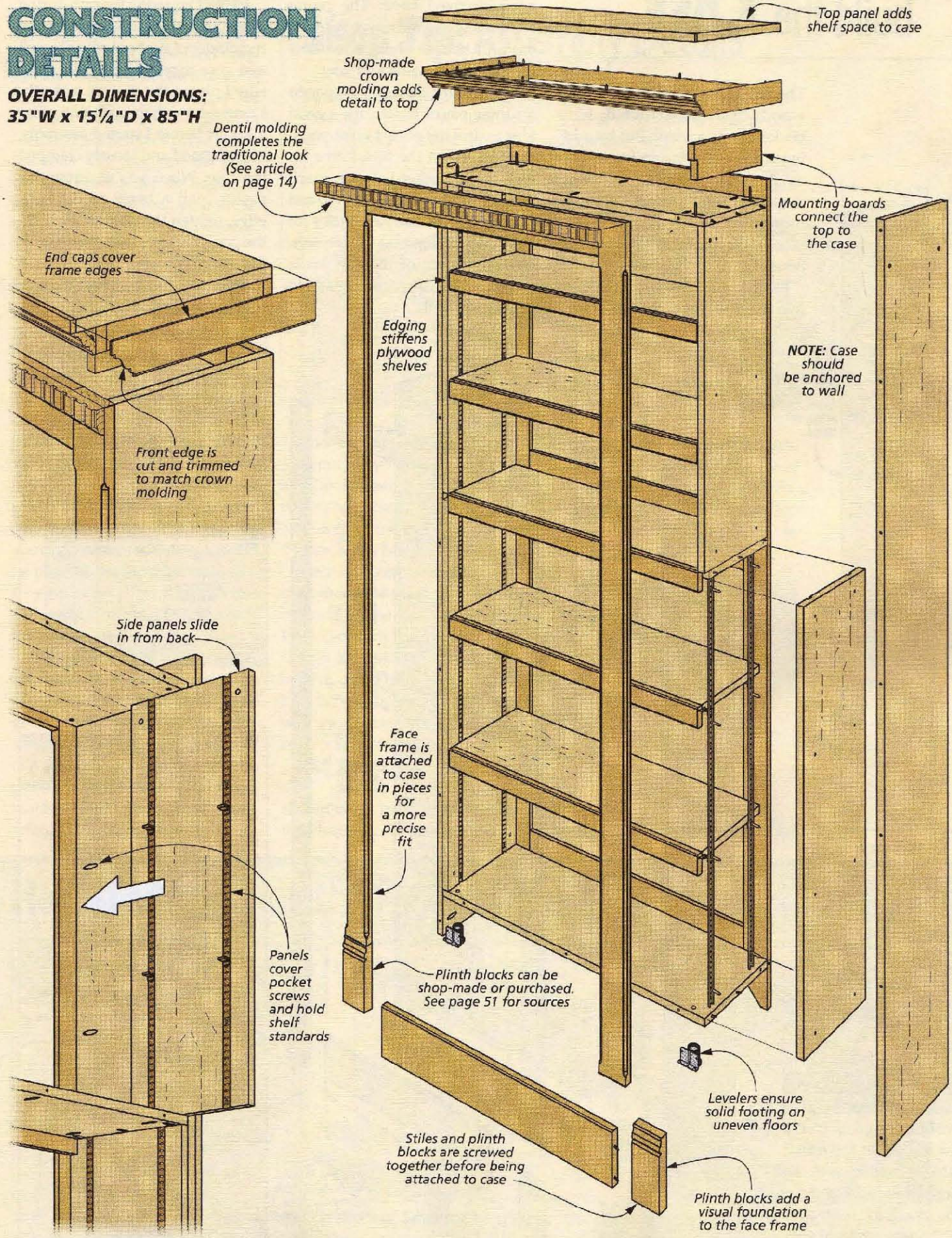
SIMPLE JOINERY. Because the case and shelves are all cut from plywood, you'll be off to a running start. And there's no complicated joinery, which makes the work go even faster. Pocket hole screws hold the case together and are used to assemble the face frame and back panel for a quick build.

MORE THAN ONE. The shop-made trim is flush with the sides of the case, so additional bookcases can be built. Plus, they'll fit well together and look like one unit when standing side-by-side.

With easy construction, simple joinery and fine details, this project is sure to be a favorite.

CONSTRUCTION DETAILS

OVERALL DIMENSIONS:
35"W x 15¼"D x 85"H



build the CASE

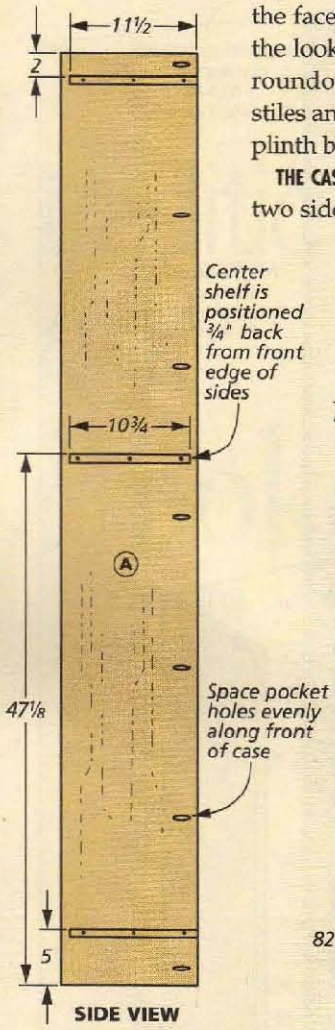
The bookcase starts off as a plywood case, constructed with pocket-screw joinery. But by adding some basic design features to the face frame you can spruce up the look. I used a simple, stopped roundover on either side of the stiles and completed the look with plinth blocks at the base.

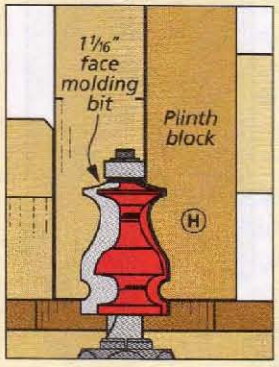
THE CASE. The case is made up of two sides, with a top, bottom, and a center fixed shelf. The center shelf is slightly narrower than the top and bottom shelves to allow for the edging you'll add later.

After cutting the plywood panels for these pieces to size, it's a good idea to drill the pocket holes you'll need to attach the face frame, as well as the pocket holes to attach the shelves to the sides. The top and bottom shelves also need holes for attaching the top and the levelers. The placement of these holes is shown in the main drawing and in details 'a' and 'b.'

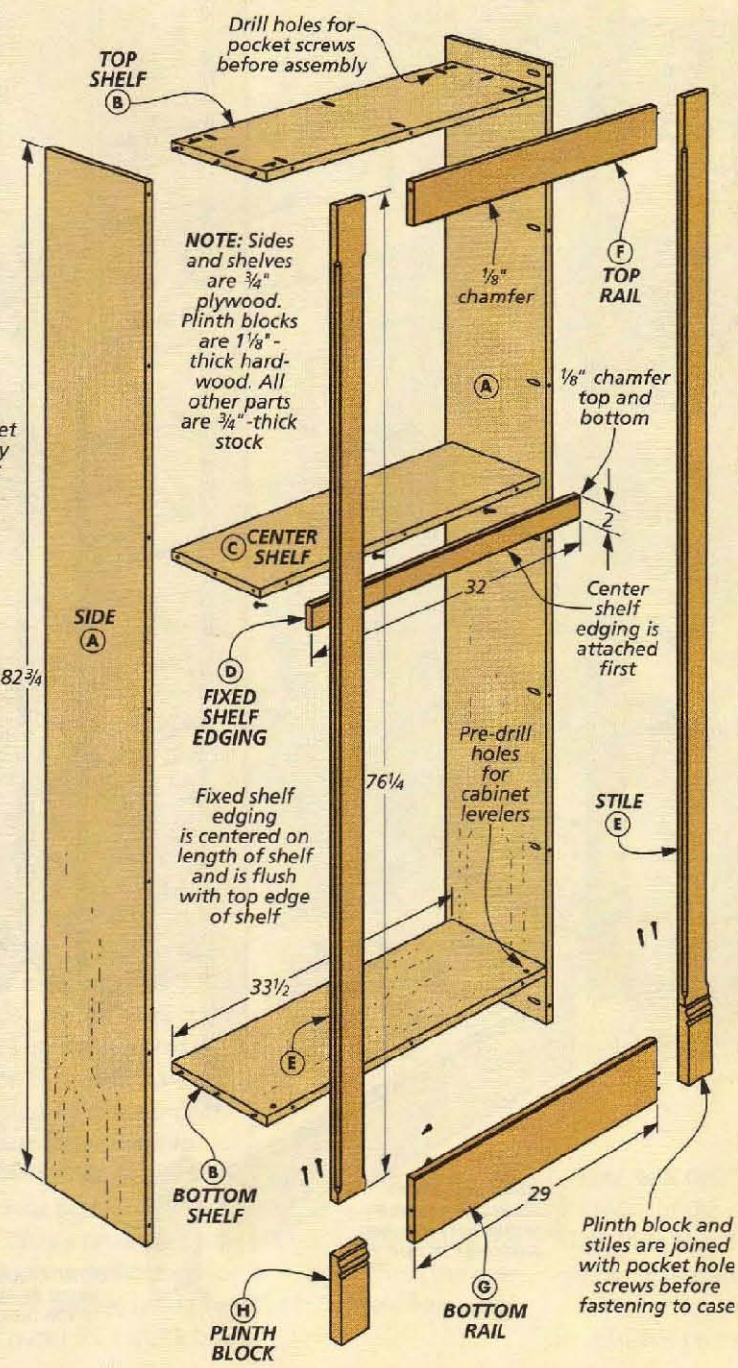
ASSEMBLY. Squaring the case during assembly is important so that the remainder of the bookcase fits well and goes together easily. To make sure I placed the shelves correctly, I marked out their positions using a square before I started assembly. Then I glued and loosely clamped the case. When you're certain it's square, nail a brace to the back edge, tighten the clamps, and add the pocket screws (see Shop Tip on the opposite page).

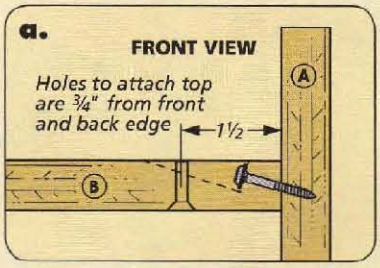
CENTER SHELF. But you start the face frame, the centered edging on the

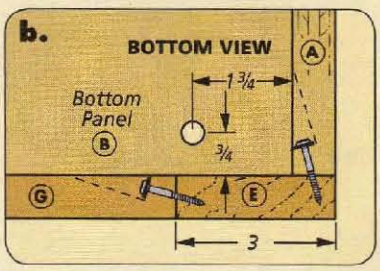


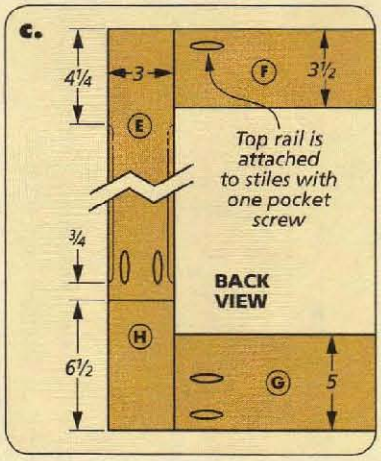


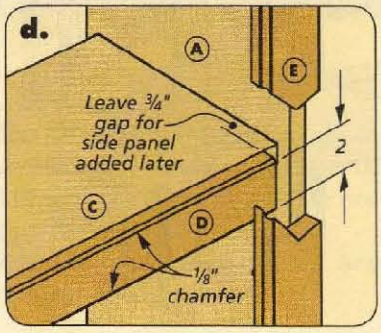
Profile. *The plinth blocks are shaped at the router table. I started with an extra-wide blank and cut the blocks to width after routing the profile in multiple shallow passes.*











center shelf should be attached. This edging is fastened to the center shelf first so that the face frame can lay over it. It's centered along the front edge to create a gap for the side panels you'll add later (detail 'd'). A scrap of plywood on the ends will give you the spacing you need. After the edging is attached you can turn your attention to the stiles and plinth blocks.

ADD THE FACE FRAME

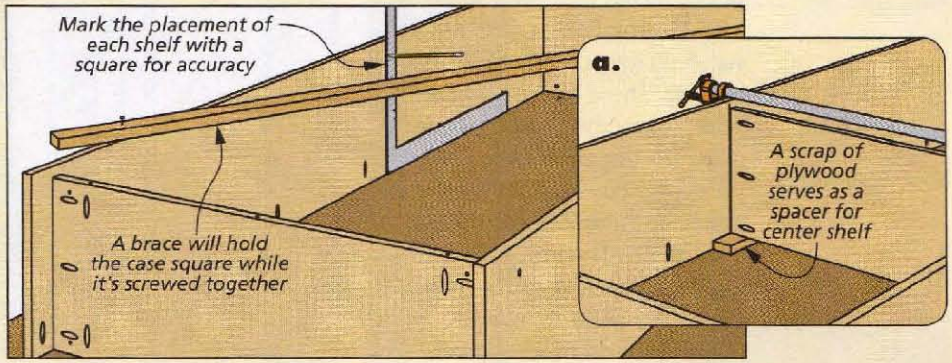
Rather than assembling the face frame and then attaching it to the front of the case, it's best to attach the frame in pieces. This way, you'll have an easier time aligning the individual pieces with the case. You can start by attaching the stiles and plinth blocks and then adding the top and bottom rails.

STILES. The face frame stiles have stopped roundovers on the front edges. There's more information about routing these roundovers on page 29. Set the stiles aside after they're routed. They'll be attached to the plinth blocks after you shape the blocks in the next step.

PLINTH BLOCKS. The plinth blocks are made on the router table. You can read more about routing this profile in the margin on the opposite page and on page 40. Instead of making your own, you can also purchase plinth blocks. For information on where to find them, refer to Sources on page 51.

Shop Tip: Assembly Details

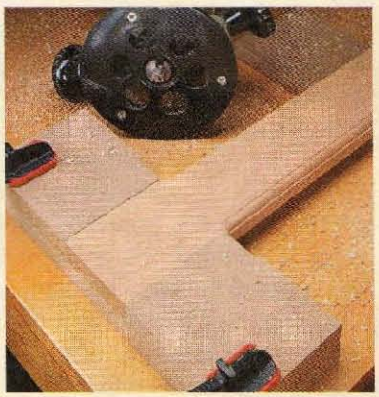
Squaring the Case. *Keeping the case square and the shelves in position during assembly is important. The drawing below shows several tricks you can use to help accomplish this.*



Once the stiles and plinth blocks are routed, you're ready to fasten them together using glue and pocket hole screws. Then attach the assembly to the case as shown in the box at the bottom of the page.

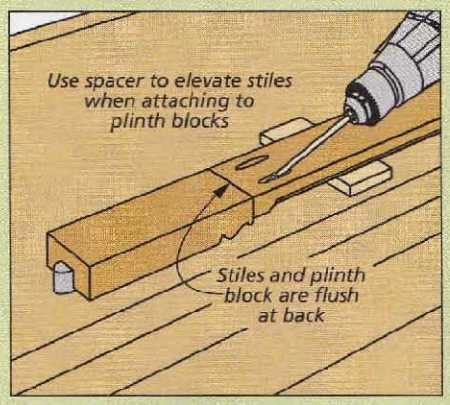
Since I wanted to make sure that the stiles were flush with the outside edge of the case at every point, I worked from the the bottom up. Clamp the stile in place near the bottom and attach it with pocket hole screws. Keep working your way up, making sure the outside edge is flush as you go.

RAILS. The face frame rails have a ⅛" chamfer on one edge, as shown in the main drawing. Once the chamfers are routed, you can cut them to fit between the stiles. The rails are screwed to the case through the pocket holes in the shelves. They're also screwed to the stiles and plinth blocks, as shown in detail 'c.'

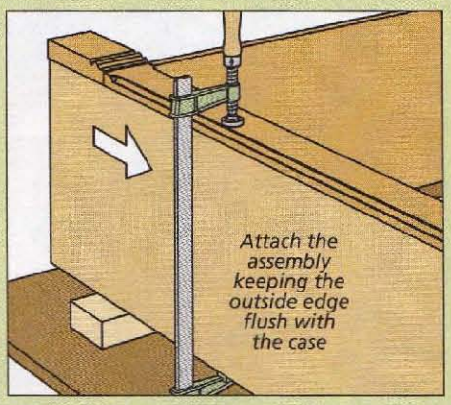


For a simple jig to rout the stopped roundover on the stiles, refer to page 29.

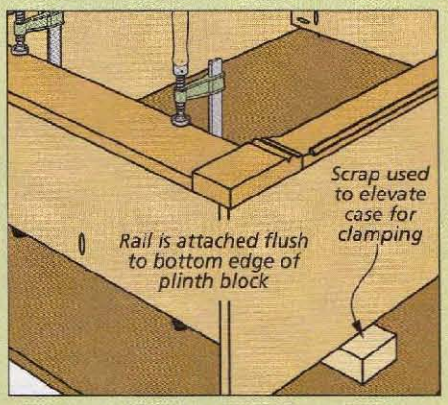
How-To: Applying the Face Frame



Side Sections. *The plinth blocks are fastened to the stiles before attaching this assembly to the front of the case.*



Glue and Screw. *After applying the glue, clamp the stile in place and install a pocket hole screw. Work your way toward the top.*



Fit the Rails. *The rails are cut to fit between the stiles and plinth blocks. Then they are glued and screwed in place.*

adding the PANELS & BACK

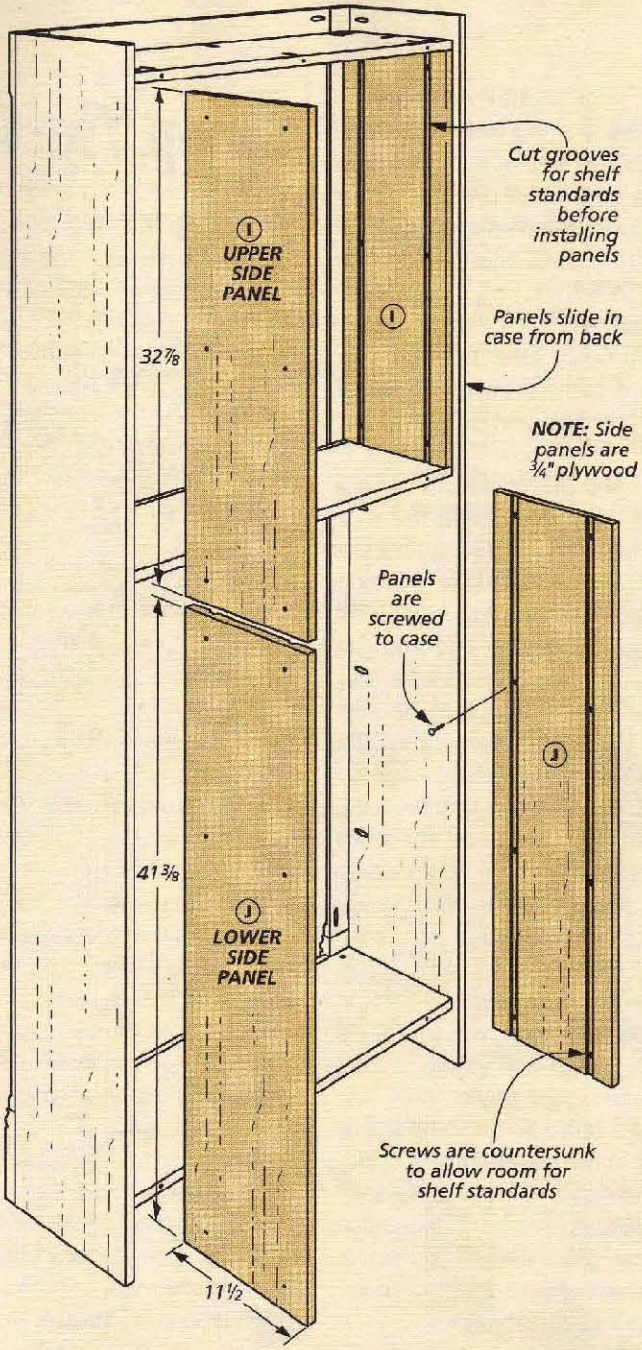
The interior of the case has several pocket holes that need to be hidden. For this reason, I added side panels in the case to form a smooth interior. These four plywood side panels cover the pocket holes in the case, but they also have a second purpose. They hold the shelf standards for the adjustable shelves.

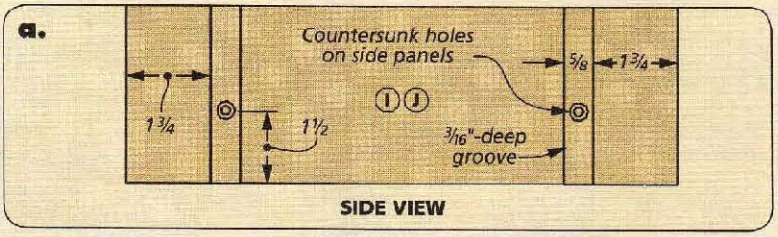
CUT TO SIZE. The first step in making the panels is to cut them to size. They slide in from the back of the case and fit snugly between the fixed shelves, which can make installing them a challenge. But if you bevel the ends when cutting them to length, as shown in detail 'c,' you'll find that it's easier to slide them in place.

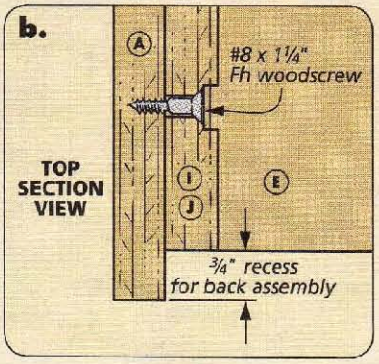
After you have the panels cut to size, you can cut the grooves for the shelf standards as shown in detail 'a.' I did this with a dado blade on the table saw. Then drill the countersunk holes in the grooves for the screws that will be used to attach the panels to the case (detail 'a').

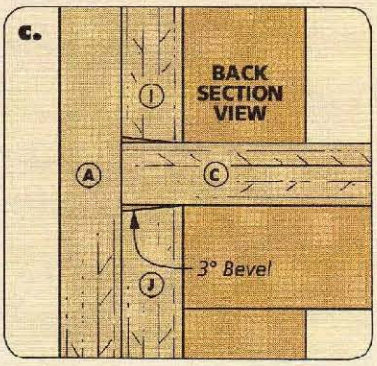
With the panels complete, you can slide them in from the back of the case until they rest against the back of the face frame. The lower panels should fit snugly in the gap that you left when you attached the edging on the center shelf.

Now, screw the panels in place. The shelf standards are attached later after the finish is applied. When the panels are in place, you'll notice they form a recess for the back frame assembly.









BUILD THE BACK FRAME

I made a frame and panel back to give the interior of the case a more finished look. Even though it may look complicated, you'll see that it's still easy to build.

Just like the rest of this bookcase, the back frame is assembled with pocket hole screws. The plywood back panels are glued into a rabbet on the back of the frame after it's assembled.

RAILS AND STILES. To build the frame, first I cut the rails and stiles to size. To form legs at the bottom of the frame, I beveled the ends of the stiles (main drawing).

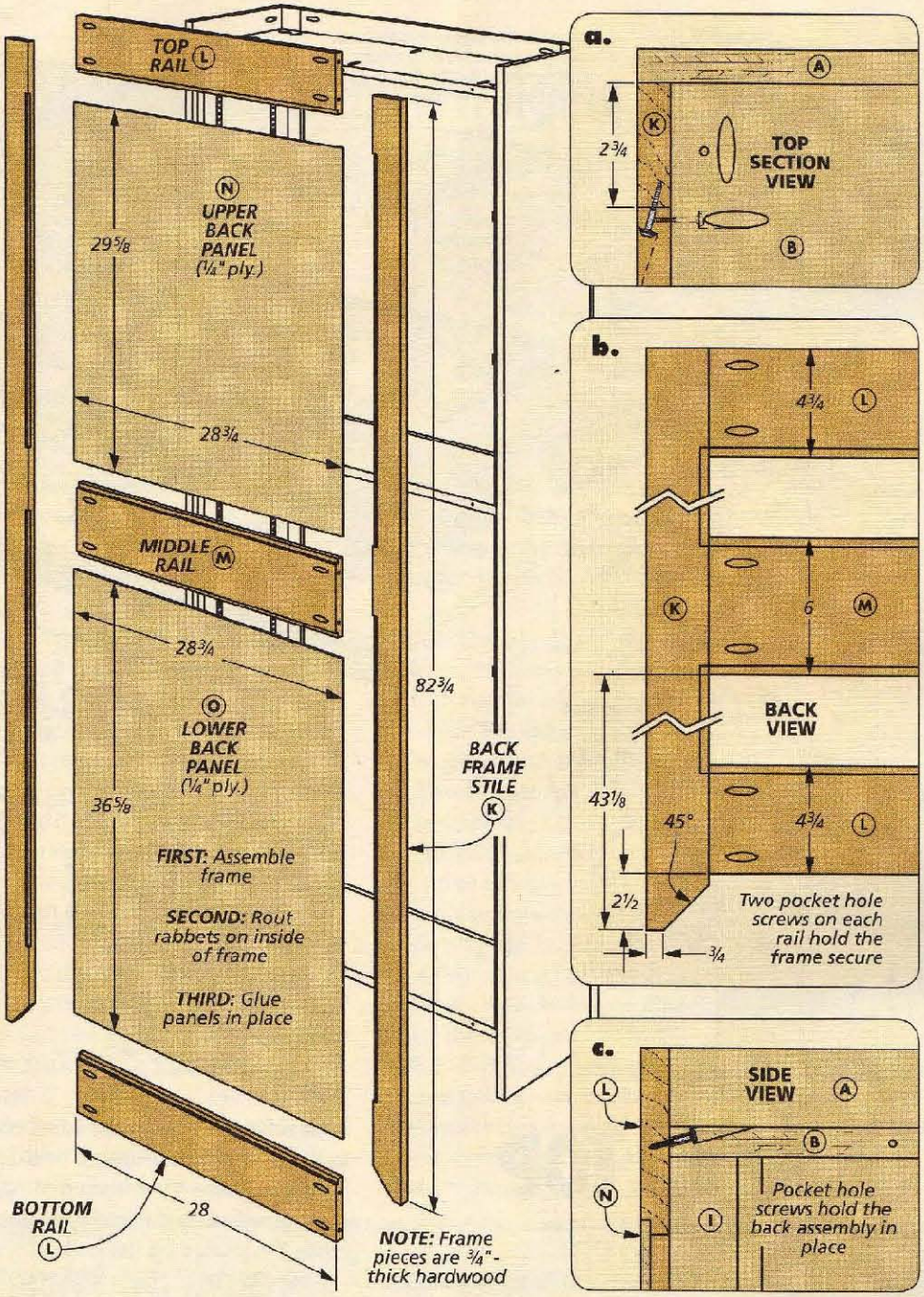
Once the stiles and rails are cut to size, you can drill the holes for the pocket hole screws and assemble the frame (detail 'b'). Then you can turn your attention to cutting the rabbets in the frame openings.

RABBETS. To create the rabbeted openings for the back panels, I clamped the frame to my workbench and used a hand-held router with a rabbeting bit. There's more information about this operation in the box below.

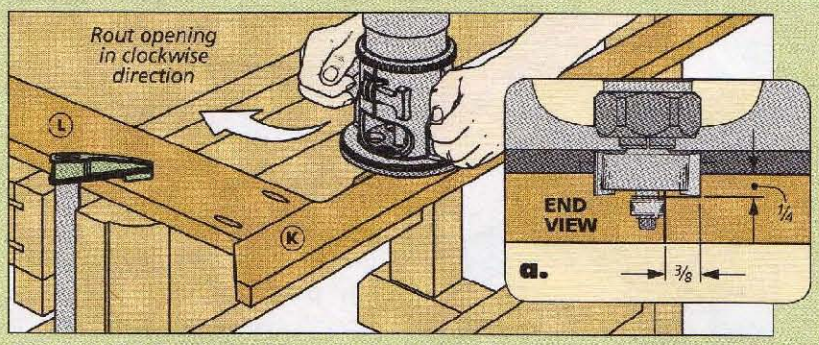
PANELS. When you have the rabbets routed, you'll need to square up the corners with a sharp chisel. Then cut the panels to size and glue them in place in the frame.

ATTACH THE BACK. The frame and panel assembly fits inside the case, flush with the back edge of the sides. To install it, first I glued the frame to the sides of the case. Then I attached the fixed shelves to the rails in the back frame with pocket hole screws (detail 'c'). This adds rigidity to the back and gives support to each of the fixed shelves.

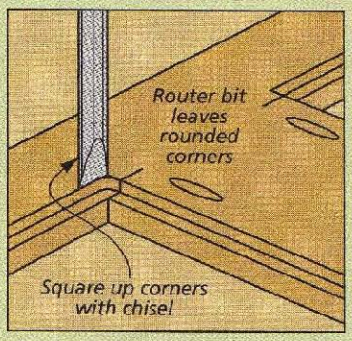
With the back panel in place, you're heading towards completion of the bookcase. All that's left is to add the top and then some adjustable shelves. If you'll turn the page, you can get started on the top assembly.



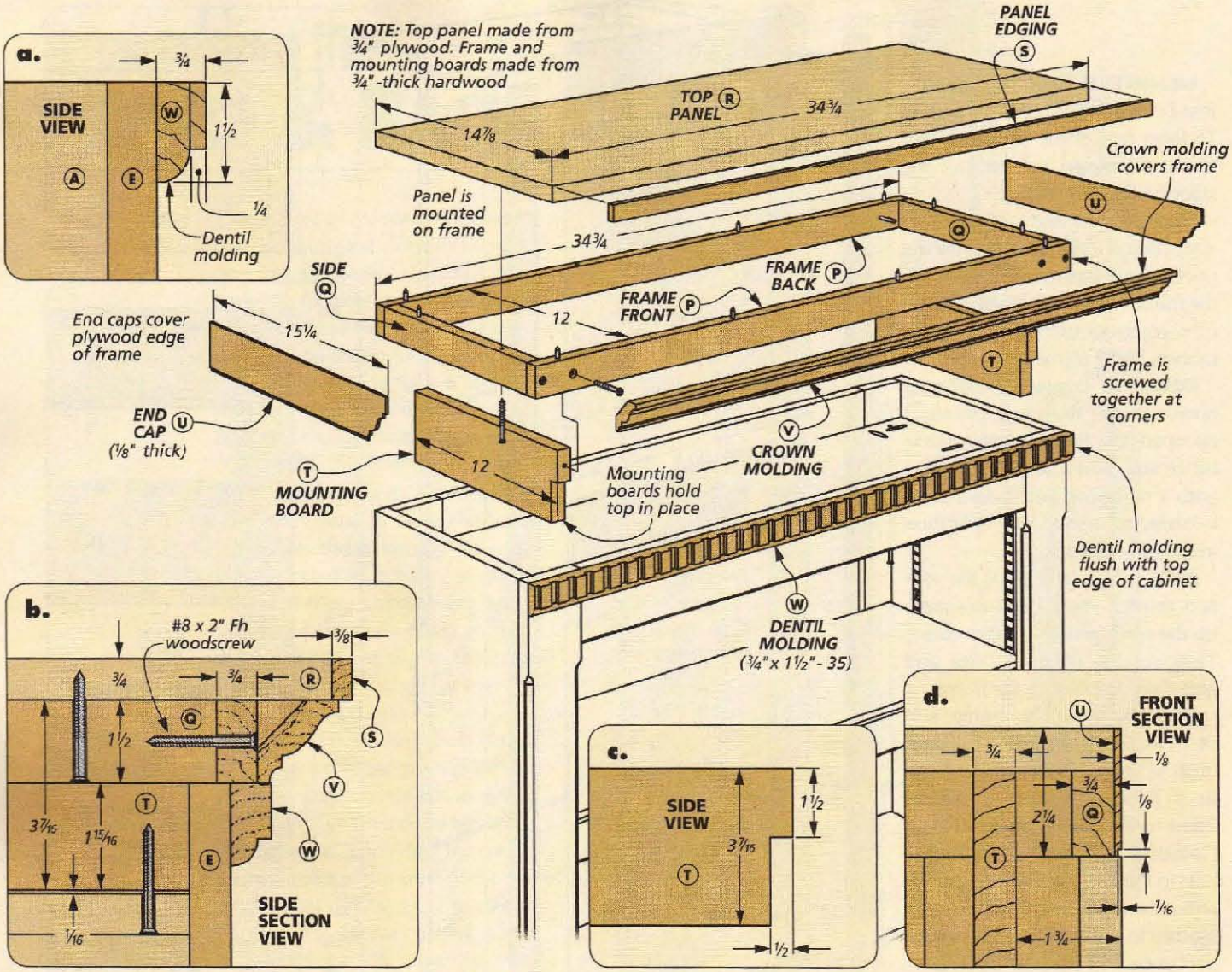
How-To: Make a Rabbeted Opening



Routing the Rabbets. *A hand-held router makes short work of creating the rabbeted recess for the panels in the back frame. Clamp the frame to your workbench to stabilize the workpiece during routing.*



Corners. *Square the corners of the rabbets before fitting the panels in the opening.*



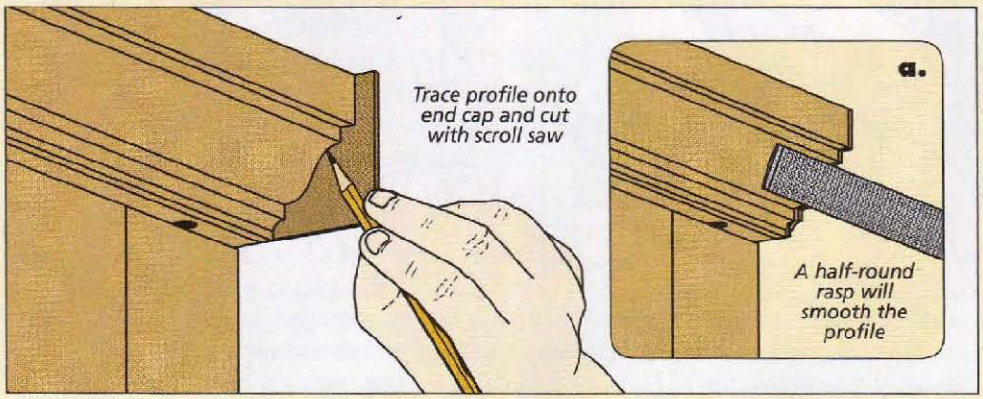
making the TOP

I used crown and dentil moldings to accent a built-up top and complete the traditional look of the bookcase. A hardwood frame holds the plywood top and provides a solid anchor for the crown. The top is built separately and then attached to the case. Two mounting boards hold it in place. Then the molding is wrapped around it and end caps cover the joinery on the ends.

FRAME AND PANEL. The frame is the backbone that holds the top assembly together. The frame pieces are simply cut to size and assembled with butt joints and screws. I added edging to the front of the plywood top panel. After the edging is glued to the plywood, attach the panel to the frame with screws as shown in detail 'b.'

MOUNTING BOARDS. To attach the top to the case, I used a pair of mounting boards. After cutting the mounting boards to size, I cut a notch on the front end of each to fit over the face frame. Once they're complete, you can attach them to the frame (detail 'b').

CROWN MOLDING. The crown molding covers the front of the frame and adds detail to the bookcase. I shaped it on the router table and attached it to the frame under the top panel (detail 'b'). As you rout the molding, take multiple shallow passes on the router for a smooth, chatter-free profile. You'll find more information about this in the How-To box at right and in the article on page 40.



After you've finished shaping the molding, take it over to the table saw and rip a bevel on both edges, as shown in the right drawing at the bottom of the page.

END CAPS. I used two, thin hardwood end caps to cover the frame sides and the end grain of the crown molding. They're shaped on one end to match the crown molding profile. You can mark the profile using the crown molding as a guide, as shown in the drawing at the bottom of the opposite page. Then cut the profile with a scroll saw or coping saw and clean up the edges with a rasp and sandpaper. To create a shadow line, I cut a rabbet on the bottom of the end caps (detail 'd'). Then glue the caps to the ends of the top.

ATTACH THE TOP. Once the top is assembled you can attach it to the case. The mounting boards fit into the recess in the top of the case and are attached to the case with screws through the top shelf (detail 'b'). You'll notice that the mounting boards are slightly shorter than the depth of the recess in the case. This is so you can draw the assembly down into the recess and the frame will fit snugly to the top of the case. For this reason the screws should not be overtightened.

DENTIL MOLDING. To complete the top of the bookcase, I added a piece of dentil molding. Dentil molding is a type of trim that has evenly spaced "teeth" across a flat workpiece. The dentil molding attaches to the front of the case just under the crown molding. The roundover on the bottom of the molding gives it a more finished look.

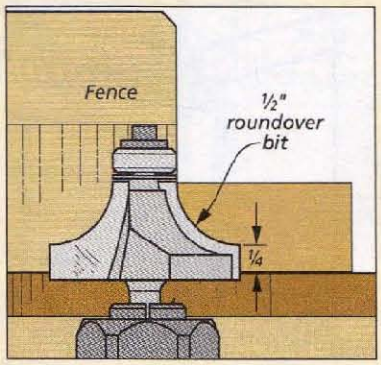
To make the molding, start by cutting an extra-long blank to width. Using an extra-long blank will allow you to trim the molding to length after making the dentils so that it ends in the middle of a notch at both ends. This way, if you plan to make more than one case, the dentil molding will butt together and create a seamless appearance across the bookcases when you stand them side-by-side.

With the blank for the dentil molding in hand, you can start by routing the roundover along one edge. For this, I turned to the router table and a ½" roundover bit. You can see how I did this in the box above.

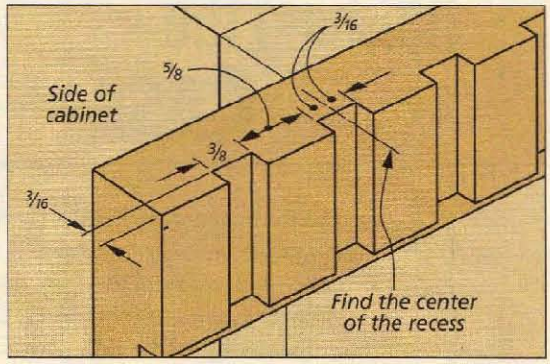
The dentils are made on the table saw, using a simple jig. You can read more about how this is done in the article on page 14. After the molding is complete, it's simply glued to the front of the bookcase, directly below the crown molding.

WHAT'S NEXT. There's not much left to completing the bookcase. All that's needed is to add the adjustable shelves. You'll see how I made these on the next page.

Shop Tips: Dentil Molding Details



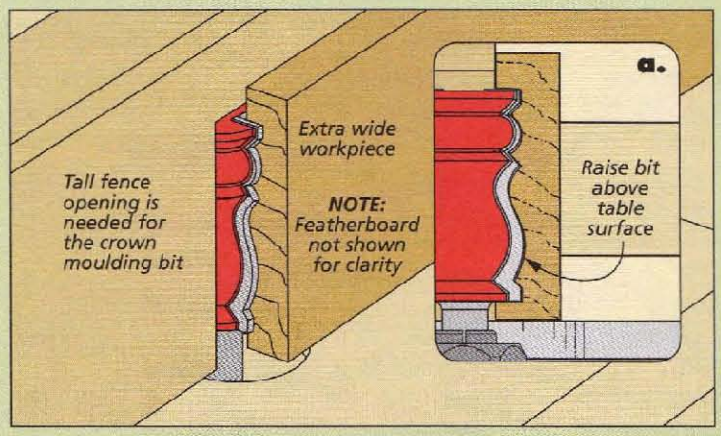
Roundover. *Before cutting the dentils, rout a roundover on the bottom edge of the blank.*



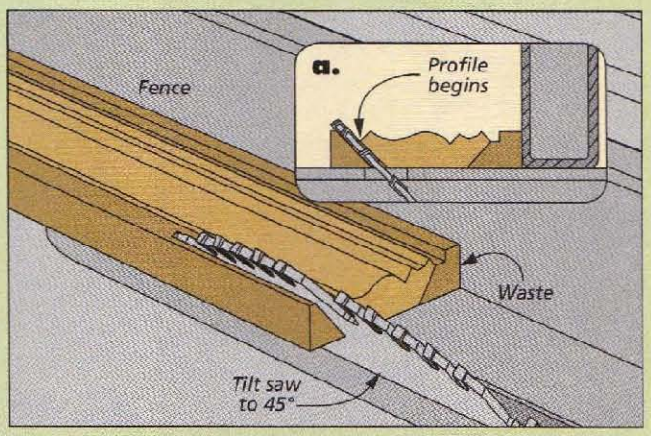
Cut to Length. *After the dentils are cut, you can fit the molding to the front of the case. Cut it in the center of a recess for the best appearance.*

For an article on making dentil molding, refer to page 14.

How-To: Make Crown Molding



Crown Molding. *Rout the crown molding profile on an extra-wide blank. Make several passes on the router table, taking a little off with each pass until you reach the full depth of the profile.*



Back Bevels. *Cut 45° bevels on the back of the crown molding blank to fit into the overhang of the top panel. The cut should start where the profile ends, as shown in the detail.*

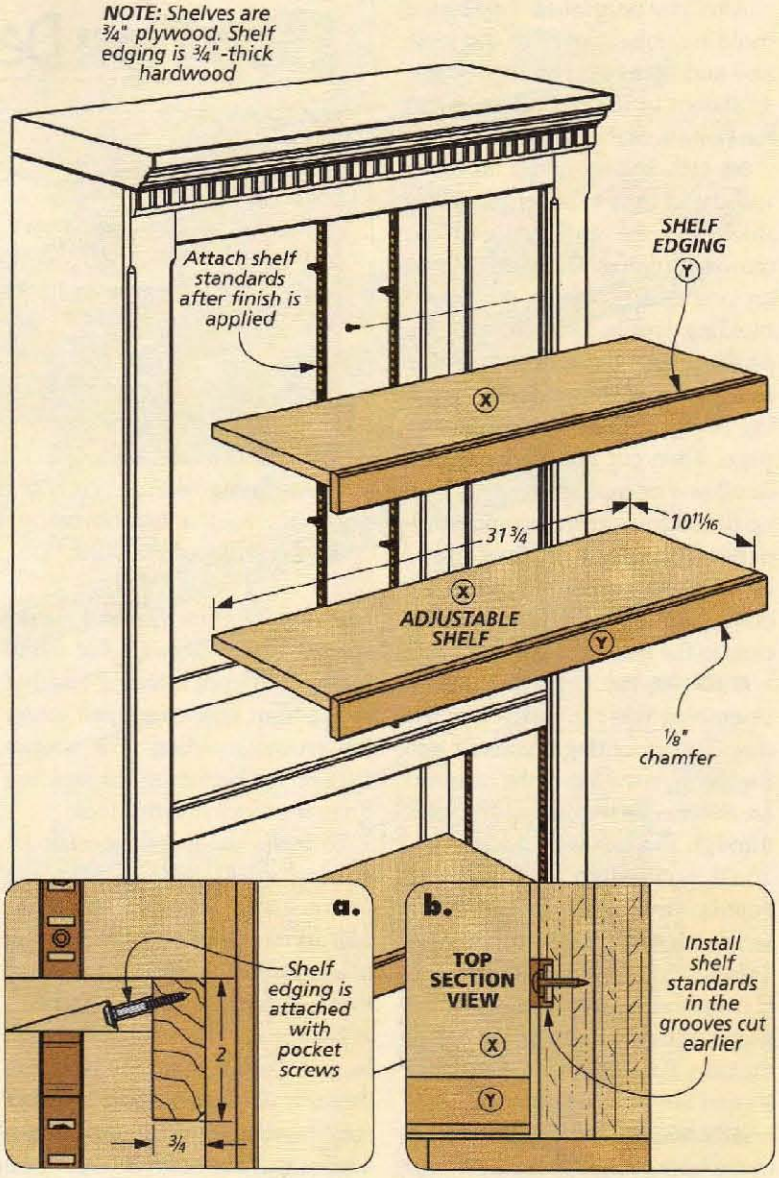
finishing the CASE

The four adjustable shelves for the bookcase are also plywood, with hardwood edging. The edging adds strength to the shelf and covers the exposed edge of the plywood.

To make the shelves, first start by cutting the plywood to size. But before adding the edging, you'll need to rout the chamfers on both front edges. When the shelves are complete, all that's left is to add a finish and install the hardware.

FINISH. Once the bookcase is complete, you can apply the stain and lacquer finish and then add the shelf standards. Levelers will keep the bookcase standing straight on uneven floors, but tall cases like this should also be anchored to the wall for added safety. For sources to purchase wall anchors and other hardware, refer to page 51.

After you install the hardware, all that's left to do is add your favorite books. Or you can build additional bookcases and connect them, as shown on the opposite page.



Materials & Supplies

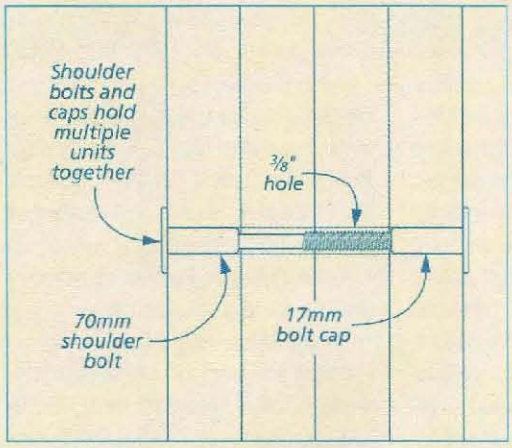
A	Case Sides (2)	¾ ply. - 12¼ x 82¾
B	Top/Bottom Shelves (2)	¾ ply. - 11½ x 33½
C	Fixed Shelf (1)	¾ ply. - 10¾ x 33½
D	Fixed Shelf Edging (1)	¾ x 2 - 32
E	Stiles (2)	¾ x 3 - 76¼
F	Top Rail (1)	¾ x 3½ - 29
G	Bottom Rail (1)	¾ x 5 - 29
H	Plinth Blocks (2)	1⅛ x 3 - 6½
I	Upper Side Panels (2)	¾ ply. - 11½ x 32⅞
J	Lower Side Panels (2)	¾ ply. - 11½ x 41⅜
K	Back Stiles (2)	¾ x 2¾ - 82¾
L	Back Top/Bottom Rail (2)	¾ x 4¾ - 28
M	Back Middle Rail (1)	¾ x 6 - 28
N	Upper Back Panel (1)	¼ ply. - 28¾ x 29⅝
O	Lower Back Panel (1)	¼ ply. - 28¾ x 36⅝
P	Top Frame Front/Back (2)	¾ x 1½ - 34¾
Q	Top Frame Sides (2)	¾ x 1½ - 12
R	Top Panel (1)	¾ ply. x 14⅞ - 34¾
S	Top Panel Edging (1)	⅜ x ¾ - 34¾
T	Mounting Boards (2)	¾ x 3 7/16 - 12
U	End Caps (2)	⅛ x 2¼ - 15¼
V	Crown Molding (1)	¾ x 2⅛ - 35
W	Dentil Molding (1)	¾ x 1½ - 35
X	Adjustable Shelves (4)	¾ ply. - 10 11/16 x 31¾
Y	Shelf Edging (4)	¾ x 2 - 31¾

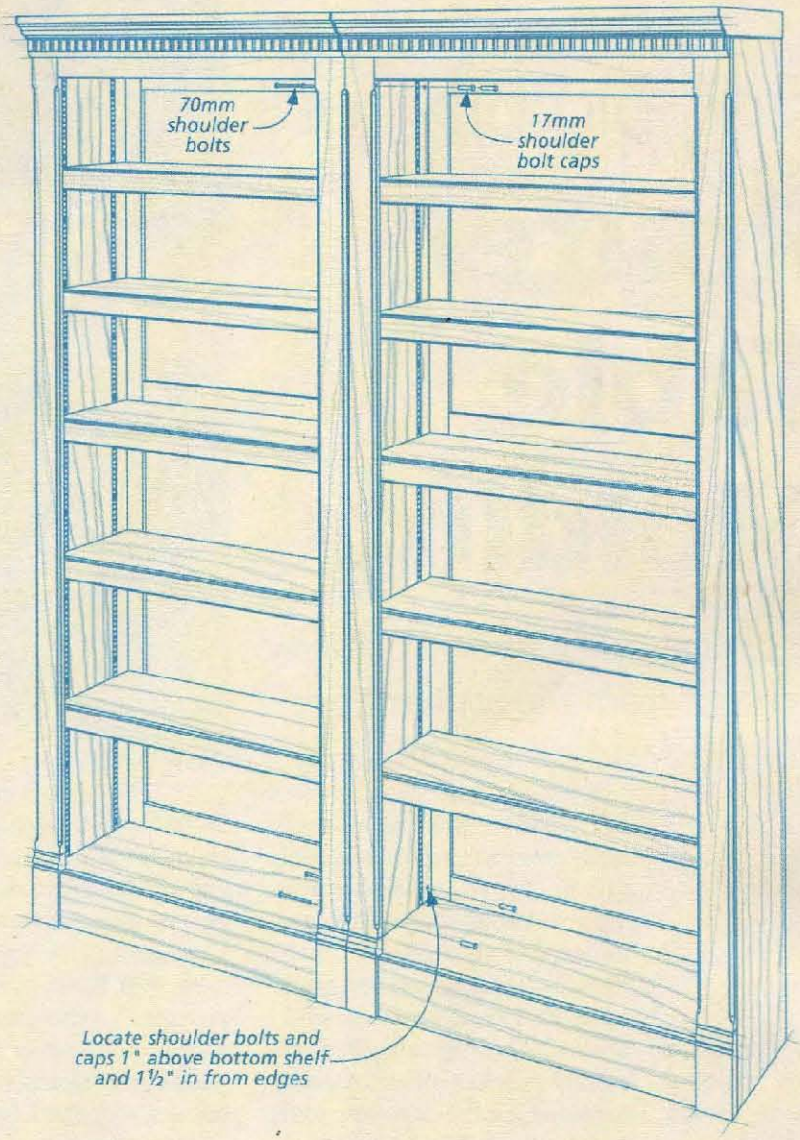
- (92) #8 x 1¼" Pocket Screws
- (24) #8 x 2" Fh Woodscrews
- (28) #8 x 1" Fh Woodscrews
- (4) ⅝" x 36" Shelf Standards w/Nails
- (4) ⅝" x 48" Shelf Standards w/Nails
- (16) Shelf Supports
- (2) Lifting Levelers with Screws
- (1) Anti-Tip Kit

DESIGNER'S NOTEBOOK

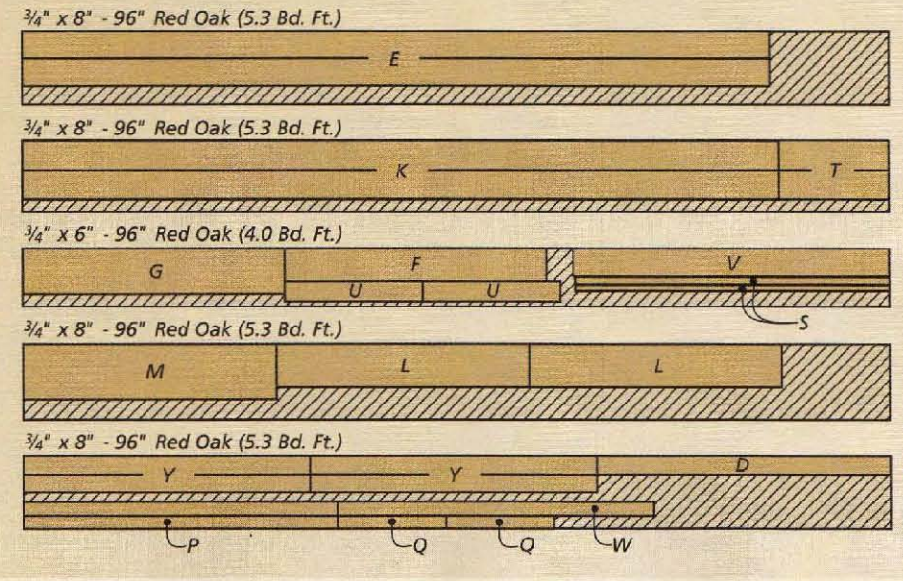
Although the bookcase looks great as a single unit, I designed it so that you can build two or three and place them side-by-side. The perfectly flat sides allow the bookcases to line up neatly. And the dentil molding is designed to appear as one continuous piece of trim.

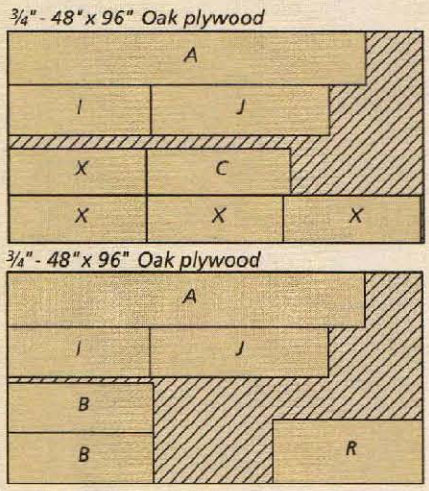
If you choose to build more than one bookcase, it's a good idea to bolt them together. To do this, simply clamp the cases together and drill holes through the mating sides for some shoulder bolts and bolt caps.



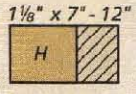


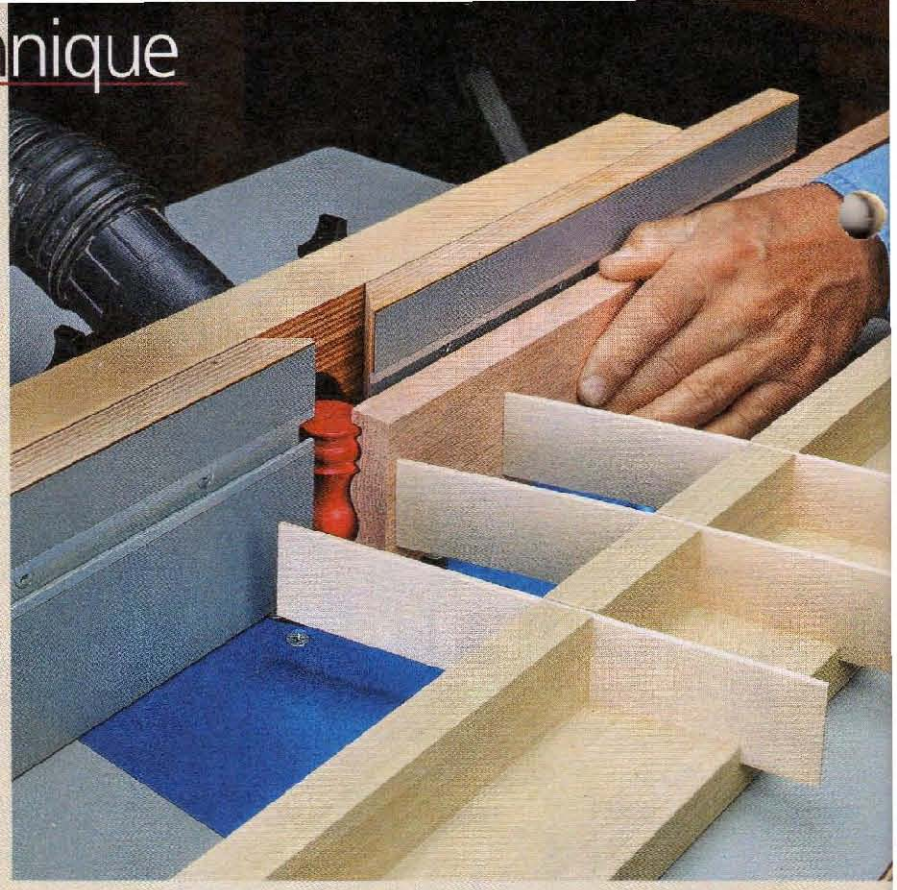
Cutting Diagram





Also Needed: 48" x 96" sheet of ¼" Oak plywood





using big bits for Router Table Molding

Get ornate, professional-quality moldings from the router table. Here's how to do the job.

I'm continually amazed at the innovative new router bits being offered by bit manufacturers. Especially intriguing are the ones designed to make complex, architectural moldings on the router table. They open up a new world of possibilities for adding sophisticated details to a project. A pair of examples are the crown molding and the plinth blocks for the traditional bookcase on page 30.

If you're accustomed to using standard-size bits, the thought of installing one of these monsters in the router table might give you shivers. But with the right setup and a little know-how, you can get great results without the anxiety. I'll explain all the key points.

THE RIGHT ROUTER. The first thing you need to consider is whether your router is up to the task. The mass of the bit and the large cutting surface mean that you'll need a fair amount of horsepower to achieve a clean, chatter-free cut. You'll get the best results with a router of 2-hp or more. Although most of these bits are not overly large in diameter (1" to 1½"), they'll work best when you run them at a slower speed. So you'll need variable speed. And just as a reminder — these bits should never be used in a hand-held router.

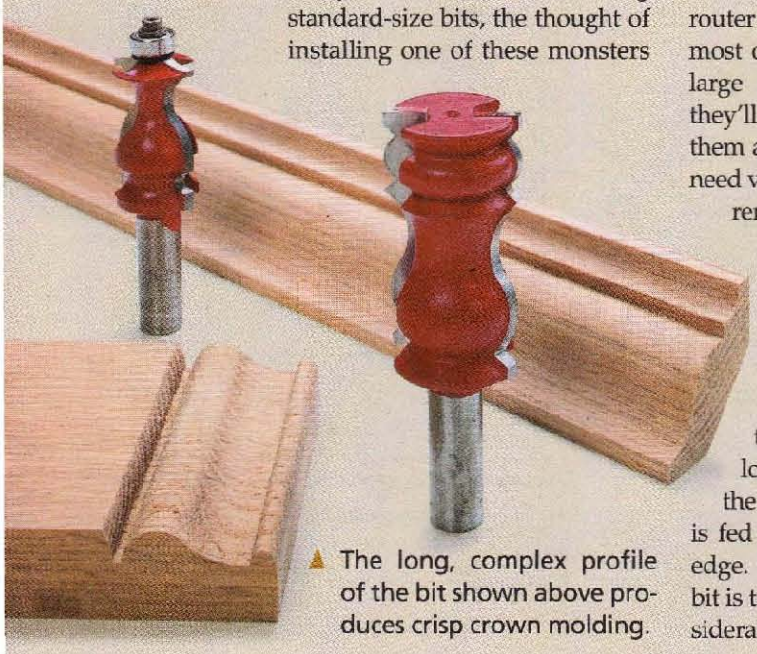
FIRM CONTROL. As you can see at left, both the crown molding bit and the face molding bit used to make the plinth blocks have very long cutting edges. To cut the profiles, the workpiece is fed across the bit standing on edge. This means that when the bit is taking a full cut, there's considerable force pushing on the workpiece. So the main challenge to using these bits is maintaining firm, safe control while making the cuts. This is simply a matter of having the right setup.

A FEATHERBOARD. Rather than relying on hand pressure to keep the workpieces snug against the fence, I enlist the aid of a shop-made, three-spring featherboard, as in the photo above. The featherboard holds the workpiece firmly against the fence so that all you have to do is concentrate on pushing it steadily across the bit. To finish the cut, it's a good idea to keep a push stick within easy reach.

TALL FENCE. The fence on your router table needs to be tall enough to accommodate the height of the bit as well as the blank. You also need enough depth to bury the entire bit in the fence. An open split fence, as shown above, is a good option. If you have a short fence, you may need to add a tall auxiliary fence.

DUST COLLECTION. One more thing. Effective dust collection is a must. The cuts produce a large volume of dust and chips. And this can clog things up fast. Keep the bit opening clear and you'll have an easier feed and get a smoother cut.

▼ You can use a face molding bit to create traditional-looking plinth blocks.

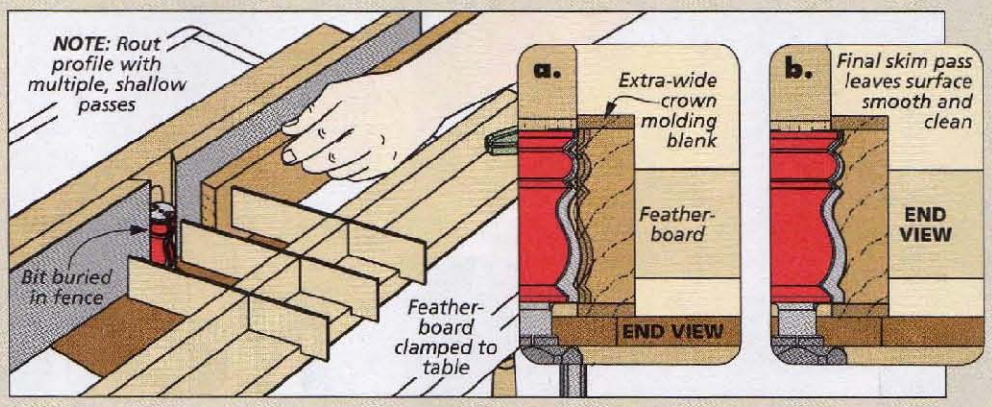


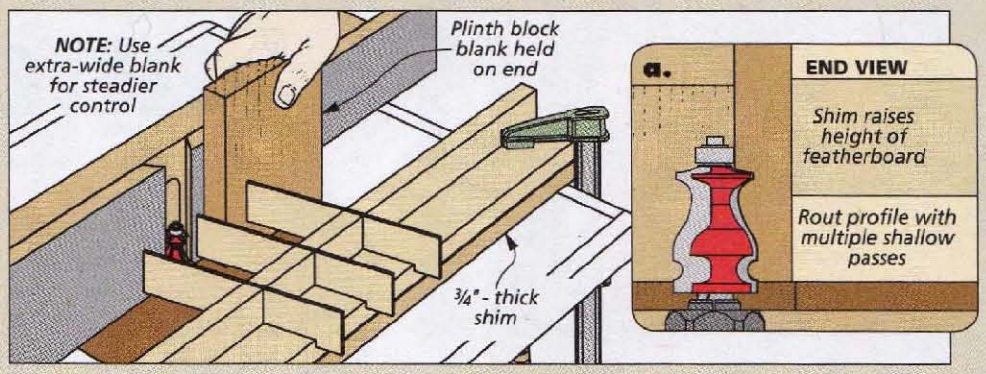
▲ The long, complex profile of the bit shown above produces crisp crown molding.

EXTRA-WIDE BLANKS. I made both the crown molding and the plinth blocks starting with extra-wide blanks, as shown in the two drawings at right. Again, good control of the workpiece is the reason.

The crown profile runs across the full width of the finished molding. So the trick is to start with an extra-wide blank. This allows you to raise the bit above the level of the table and maintain a bearing surface at the top and bottom of the blank as you cut the profile, as shown in the upper right drawing. Once the profile is completed, the blank is cut to final size and shape.

The plinth blocks go a little differently. Here, the profile is cut crossgrain along the top edge of the narrow block. To do this, you have to "balance" them on end. So to provide more bearing surface, I cut the profile onto a double width (6½"-wide) blank that was cut to finished length (lower drawing at right). This way, you'll get both plinth blocks from the one blank. And note that the featherboard is shimmed up so that it bears against the uncut section of the blank.





LIGHT PASSES. Once the blanks are sized and the router table is set up properly, cutting the profiles isn't hard. You start with most of the bit's cutting edge buried in the fence. Then the profile is formed with multiple, light passes — 1/16" or less. Just nudge the fence back a little after each cut, exposing more of the bit. And you'll need to adjust the springs of the featherboard after every couple of passes.

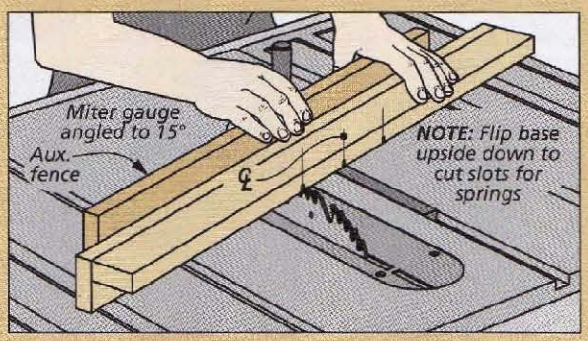
You'll find that it may take a dozen or more passes to rout the profile to full depth. All you have to do is concentrate on pushing the workpiece steadily past the bit — the featherboard does the rest. A slow, steady feed rate will give you a cleaner, easier cut.

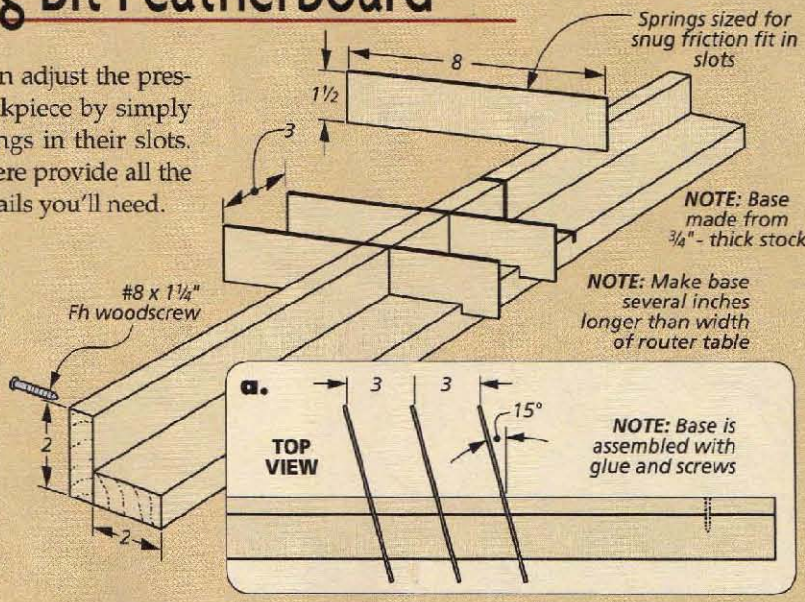
The last pass should be a "skim" cut — essentially just smoothing the profile. Maintaining a consistent feed at this point is especially important for a chatter-free result.

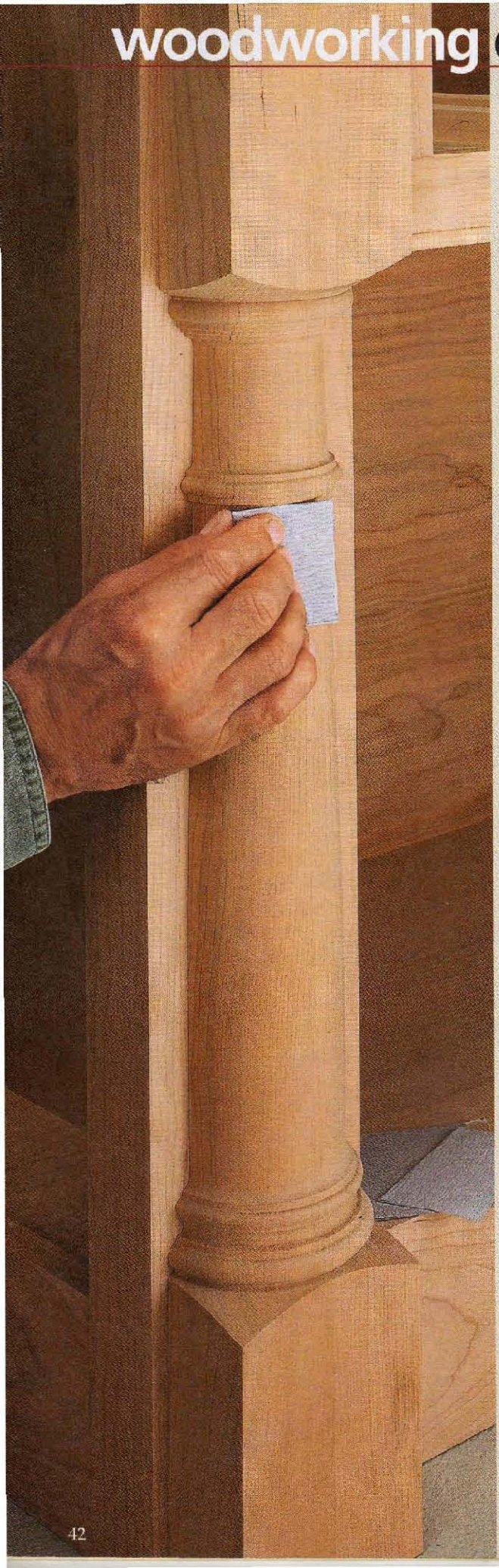
Once the profile is fully formed, you can complete the molding at the table saw. And after a bit of finish sanding, your shop-made "factory" molding is ready to go. W

How-To: Make a Molding Bit Featherboard

The featherboard consists of an L-shaped, hardwood base that holds three, stiff, hardwood springs. The springs are sized for a very snug friction fit in angled slots cut into the base. You can adjust the pressure on the workpiece by simply sliding the springs in their slots. The drawings here provide all the construction details you'll need.







back to basics

Hand Sanding

When it comes to sanding intricate details, nothing beats a sanding block and a little old-fashioned elbow grease.

Before you add the first coat of finish to a project, it's important to make sure all the surfaces are level and smooth. This often means breaking out the random-orbit sander and getting to work. But there are times when a power sander just isn't the best tool for the job.

Most projects include sanding challenges that go beyond flat surfaces. Getting into tight corners and sanding edge profiles are the obvious places where some hand sanding is necessary. And that's where a few proven techniques and sanding aids can make the difference between a flawless surface and one that's marked by dips, ridges, and swirl marks.

PICK YOUR PAPER. Before jumping right in on a project, it's worth taking a minute to lay out the supplies you'll need. For starters, I stock up on self-adhesive sandpaper. A 4½"-wide roll of each of the most commonly used grits (100, 120, 150, 180, and 220) will keep you going for quite a while. The adhesive makes this paper easy to use with just about any sanding block. At about $20 for a 30-foot roll, it's a bargain, too.

Regular sheets of sandpaper are still the staple of most shops. They have the advantage of being less expensive. And many commercial sanding blocks are sized specifically for ⅓ or ¼ sheets.

SANDING BLOCKS

The main photo at left shows how using your fingers to hold the sandpaper can be all you need for some jobs. But the friction quickly heats up your fingertips. And using your fingers can create dips. So for most tasks, you'll want to back up the paper with something flat to help create a level surface. That's why I usually turn to sanding blocks.

COMMERCIAL. My first choice for sanding blocks is the cork block shown in the left photo on the opposite page. It provides a flat face for the

Adhesive-backed sandpaper is handy for use with a block or pad.

paper, but it's soft enough to avoid gouging the surface.

Another sanding aid I use frequently is the *MicroMesh* sanding pad shown in the middle photo below. Instead of a rigid block, the pad is made of dense, but flexible foam rubber. It's great for working curved surfaces. You can find out where to buy these sanding aids in Sources on page 51.

SHOP-MADE. It's also easy to make your own sanding block. Hardwood scraps are readily available and can be quickly shaped to the task at hand. They can be just the ticket for large, flat surfaces.

Another easy-to-make solution is a thin strip of wood (about 1/16" thick) with small blocks glued to the ends. This is a great tool for sanding curved edges, like the tabletop shown in the right photo below.

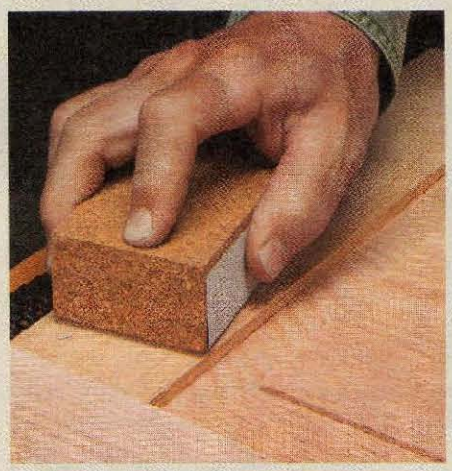
PROFILE SANDING. I always sand moldings and other profiled surfaces by hand. The hard part here is making a block that matches the profile. I often use dowels, or rout a conforming shape in a piece of scrap to use as a sanding block. The box below shows an inexpensive product that can really help.

TECHNIQUES. No matter whether you sand with a block or your fingers, basic sanding techniques are the same. Of course, you'll need to keep your strokes moving with the grain. But beyond that basic principle, you'll also want to pay attention to how the particular wood you're working with reacts.

For example, sanding white oak is very different than sanding cedar. For a hard, dense wood, you'll probably need more time with each successive grit, while softer woods take just a few minutes. A good test is to take a piece of scrap and see how long it takes to round over a corner. That will tell you a lot about how the wood behaves.

After each grit, you can wipe the surface with a tack cloth to remove the dust. It's much easier to keep an eye on your progress if you keep the surface clean. I also like to vacuum the workpiece between each grit to prevent stray particles from scratching the surface. This is particularly helpful when working with open-pored woods, like oak.

If it's been a while since you sanded a project by hand, you'll be surprised how quickly it goes. And you probably won't miss the noise of a power sander much either. But best of all, the results are sure to persuade you that hand sanding is worth the extra effort. W



▲ A cork block is rigid enough to stay flat, but soft enough to avoid digging into a workpiece.

▲ The *MicroMesh* sanding pad is firm but spongy enough to sand curved or irregular surfaces.

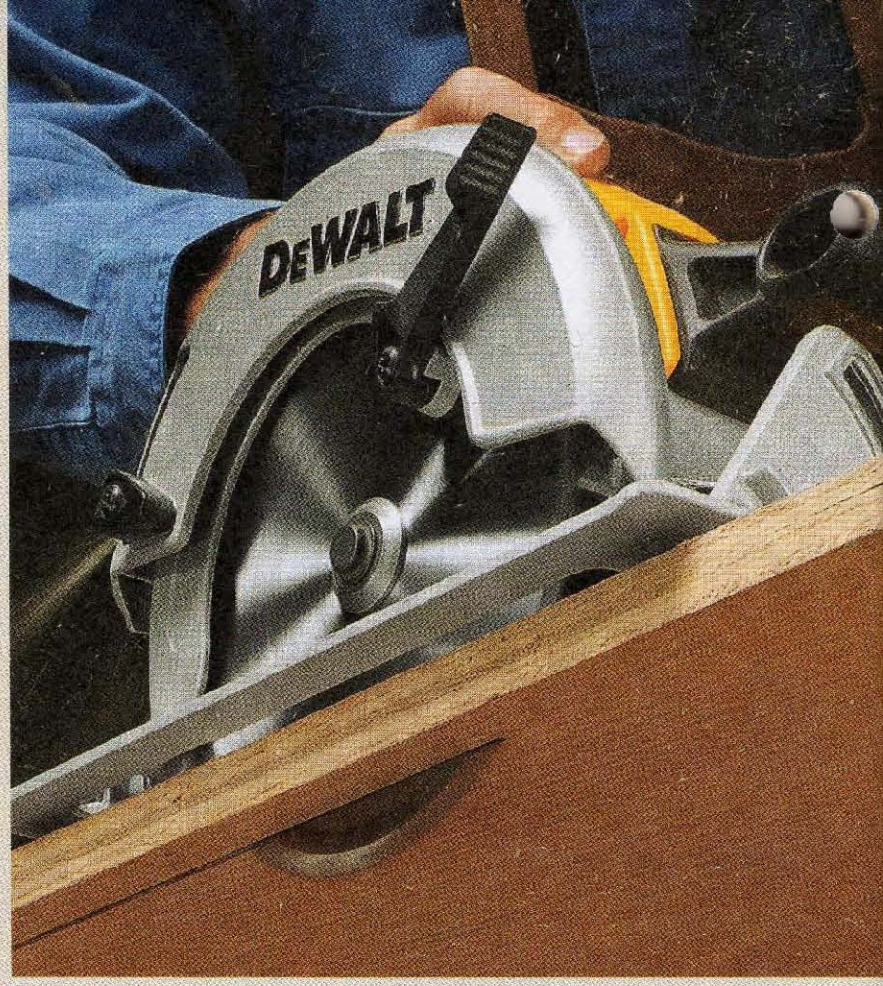
▲ A thin strip of hardwood with blocks for handles makes the perfect tool for sanding curved edges.

Worth a Look: Soft-Sanders

Sanding moldings and profiled edges can be difficult. If the block or pad is too rigid or doesn't conform to the edge, you run the risk of ruining the profile. That's why I like the *Soft-Sanders*. They offer not only a great selection of profiles, but of varying foam densities as well. You can find the right pad for just about any task (see Sources on page 51). And with these colors, you won't misplace them in your shop.

A variety of profiles and densities make the *Soft-Sanders* a handy addition to the shop. ►

putting your Circular Saw to Work



With the right setup, your circular saw can be a valuable "go-to" tool.

You'll get very good results with the moderately priced 60-tooth blade below. The high-end, 40-tooth blade will yield a superb edge.

I would wager that you could find a portable circular saw in just about every woodworking shop. But it's usually tucked away in a corner gathering dust. A circular saw is the lonely *Maytag* repairman of shop tools — always waiting, but seldom called upon.

Most woodworkers think of a circular saw as a "construction" tool known more for its speed than its accuracy. And because it's hand-guided, a circular saw can be awkward to use and a challenge to control.

Well, it doesn't have to be this way. In a small shop, a circular saw can be very handy for a variety of tasks, from cutting stock to rough size to breaking down sheets of plywood to taking on light joinery tasks. But in order to use your circular saw more productively, you have to overcome three challenges.

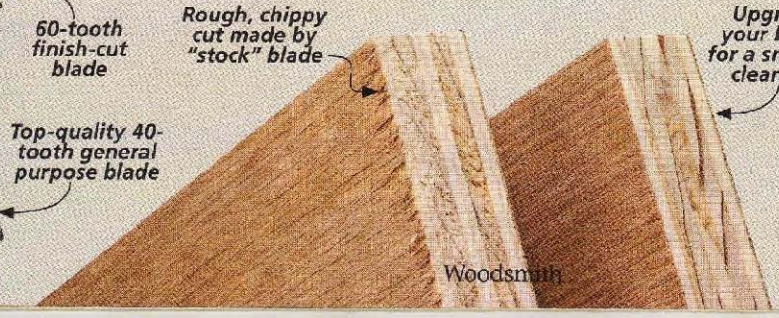
The first is achieving a smooth, clean, chip-free cut. This can be important when you're working with valuable hardwood and cabinet-grade plywood. Second, when using a circular saw, you need a reliable way to support the workpiece — both the finished piece and the cutoff. The final element is a method of guiding the saw for a straight, accurate cut. The good news is that with a little advance preparation, you'll no longer dread the thought of getting out your circular saw.

Clean, Chip-Free Cuts

The blade that comes packaged with a circular saw is generally suitable for quickly tearing through dimensional lumber and not much else. So the number one thing you can do to improve the quality of your saw's cut is to upgrade the blade.

If you're accustomed to rough cuts from a cheap blade, you'll be amazed at the difference a 40-tooth general purpose or 60-tooth finish-cut carbide blade will make. I've found that a circular saw cut made with a high-quality blade can be every bit as good as a cut from the table saw. The sample cuts in chip-prone oak plywood show the difference a good blade can make.

GOOD SIDE DOWN. The way you set up for a circular saw cut will also affect the end result. When a circular saw cuts, the leading edge of the blade spins upward into the material. This means that it exits the cut on the top side of the workpiece and the cleanest edge will be on the bottom side. So if your material has a good and a not-so-good side, put the "A" side face down.



Solid, Stable Support

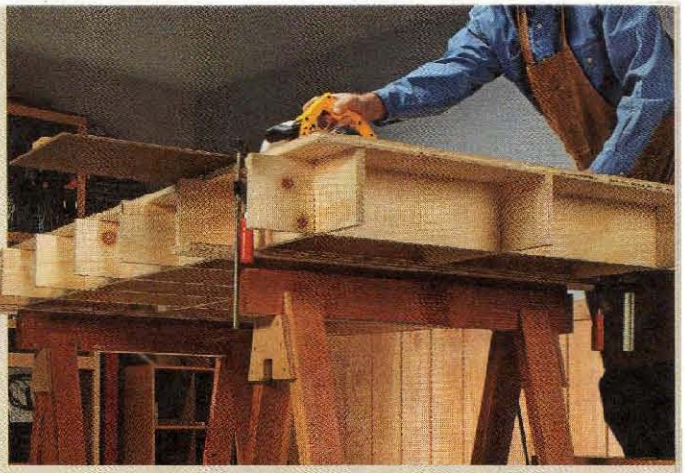
Trying to make a circular saw cut without solid support for the entire workpiece can be a nightmare. And I've learned the hard way that sawhorses alone are not the best answer. As the cut is made, the workpiece can shift and bind on the blade. And too often one or both pieces end up on the floor.

Rather than the narrow support provided by a sawhorse, you need a large surface that will steady and support both of the pieces created by the cut. And the cutting surface needs to be sacrificial and non-damaging to the saw blade.

My solution is the lightweight, but very stable, knockdown cutting table shown in the photos at right and below. The table is made up of notched, interlocking slats of ¾" plywood. It can be rapidly knocked together and then hoisted onto a pair of sawhorses at a comfortable height.

The large surface of the table will hold a full 4' x 8' sheet of plywood. The "open" design provides very solid support with virtually no resistance when cutting through a workpiece. Another big plus is that the table makes for easy clamping of both the workpiece and the cutting guides shown below.

The table is built from a single sheet of plywood. You'll find construction plans at our website.



Woodsmith GO ONLINE EXTRAS

For information on building the table and the saw guides, visit our website at Woodsmith.com.

Cutting Guides

When breaking down a sheet of plywood with a circular saw, following a layout line freehand is difficult at best. A wandering, rough cut is the norm. And this means allowing for more waste and extra work sizing the pieces later on.

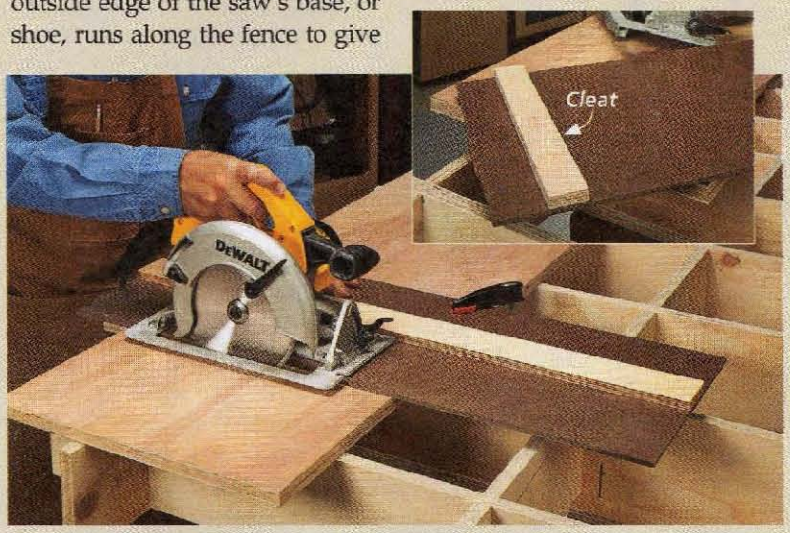
So I don't rely on my fine motor skills. I always use a guide to position the cuts and steer the saw. It's easier, much more accurate, and you'll even get cleaner cuts.

I keep two guides handy — a 60"-long version for full width panel cuts and a similar, shorter guide for accurate right angle cuts, as shown in the photos at right and below. The basis of both guides is a ¼" hardboard baseplate with a ½" plywood fence attached. The outside edge of the saw's base, or shoe, runs along the fence to give you a foolproof, right-on-the-line, and perfectly straight cut.

But the real key to the handy function of the guides lies with a simple trick. When making the guides, you position and attach the fence allowing a little extra waste along the guide edge. Then you use your saw to trim the baseplate. The resulting "zero-clearance" edge gives you a dead-on reference for easy positioning of the guide and also serves to back up the cut.

The extra-wide baseplate provides ample clamping space on the "off" side. And the addition of a perpendicular cleat to the underside of the right angle guide allows quick registration for accurate crosscuts (inset photo below). W

▲ The cutting guide can be quickly positioned and clamped to the workpiece. The cut will always follow the edge of the baseplate.



▲ The right-angle guide allows you to make accurate crosscuts on panels up to 24" wide. The key is a cleat on the underside (inset photo) that registers against the edge of the workpiece.

Shop Tip: Foam Backer

Quick and Easy. *In a pinch, a thick piece of rigid foam insulation laid on the floor provides a solid, sacrificial surface for making cuts on sheet stock.*

great results with Spray Can Finishing

If an expensive spray system is out of your reach, you can still get great results with aerosol finishes.

It's tough to beat the quality of a sprayed finish. But outfitting your shop with expensive spray equipment can be a major investment. Fortunately, most popular finishes are also available in aerosol cans. For a fraction of the cost, these "canned" products can provide a finish that rivals one applied with a shop full of spray equipment. Like any finishing task, it's simply a matter of proper preparation and using the right method.

Most popular finishes are available in aerosol cans. ▼

SURFACE PREP. To get the best results from an aerosol spray finish, you'll need to start with a little surface preparation on your project. It doesn't matter if you plane, scrape, or sand, but the surface must be clean and smooth to achieve a high-quality finish. That also means a good vacuuming and wipe-down with a tack cloth, to get rid of the any remaining sanding dust.

A PLACE FOR SPRAYING. After preparing the project, the next step is to find a safe, clean place to spray. It's not a good idea to spray in your shop unless you have a reliable system for removing the dangerous vapors. I prefer to spray outside whenever possible.

You'll also want to pick up a few things to make the job easier. The spray handle shown in the main photo is a good example. It makes spraying far less tiring for your trigger finger. A few large sheets of kraft paper are a good idea, too.

THINK IT THROUGH. Before you start spraying, it's worth taking a minute to make a plan. For instance, for the table shown in the main photo, I started by spraying the inside surfaces first. Then, after inspecting the inside, I was free to focus on the more visible outside surfaces. This "inside then out" technique is a good rule of thumb for most finishing tasks.

IT'S ALL IN THE STROKE. With the preparations complete, you're ready to apply the first coat. There are a couple of things to keep in mind as you begin. First, the key to a good finish is to build several, thin coats instead of a couple of thicker ones. So when you're spraying, always keep the stream of spray moving. If you stop, or even move too slowly, the finish can puddle or run.

You can avoid this by starting to spray off to the side of the project and holding down the button until you're past the opposite edge. The illustration at the top of the opposite page shows you what I mean.

The other thing to keep an eye on is the distance of the nozzle from the workpiece (follow the directions on the can, usually 10"-12"). Swinging your arm in an arc, from side to side, results in being closer at the center of the arc. It may not sound like much, but the consequence is a heavier coat in the middle and less on the outside edges. Try to move side to side while maintaining an equal distance to the workpiece (drawing at right). This is a sure way to maintain even coverage of the surface, without causing runs.

OVERLAP. Finally, pay attention to how far you overlap the spray pattern of each successive pass. For the first coat (where the raw wood will drink up the finish), I usually overlap about half the width of the stroke, resulting in two light coats. The drawings below give you an idea of how to approach the task.

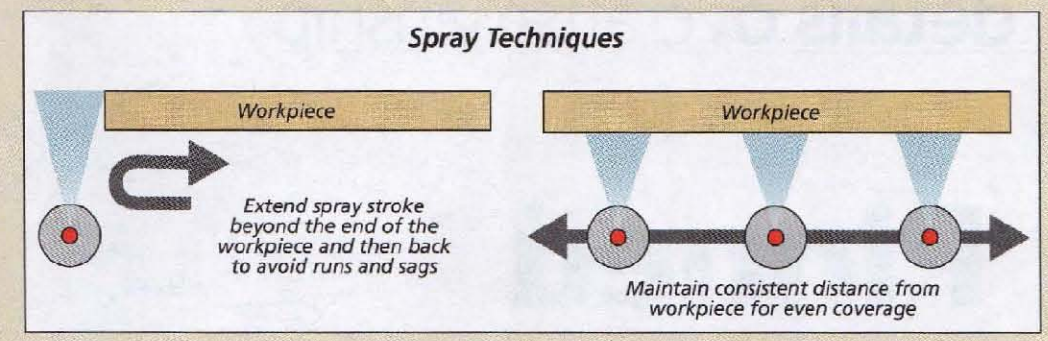
QUICK BUILD-UP. One of the biggest benefits of spraying a finish is how quickly you can apply additional coats. Since a sprayed coat is thinner than a brushed finish (much more of what you're spraying is solvent), the surface is soon ready for another coat.

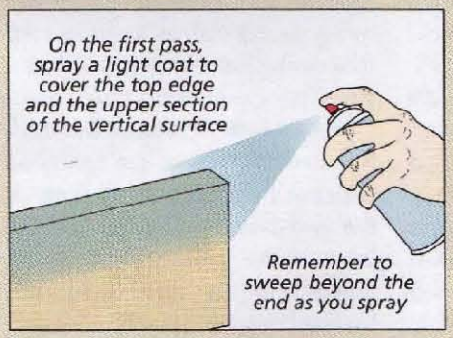
Of course, how quickly the finish dries depends on the temperature, humidity level, and the type of finish. Lacquer, for instance, can be ready in less than an hour. Polyurethane may take a bit longer, but still is usually ready for a second coat long before a brushed application of the same finish.

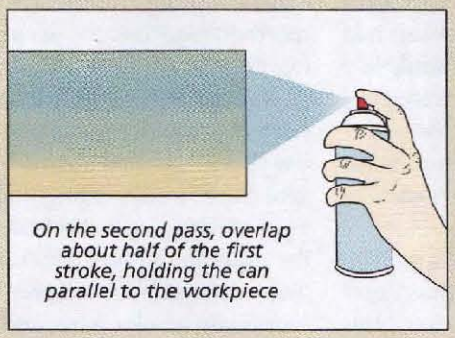
GIVE IT A REST. After the first two or three coats, I like to let the project sit overnight and allow the finish to cure. Then you can give it a light sanding and add another couple of coats. For many projects, this might be all you need.

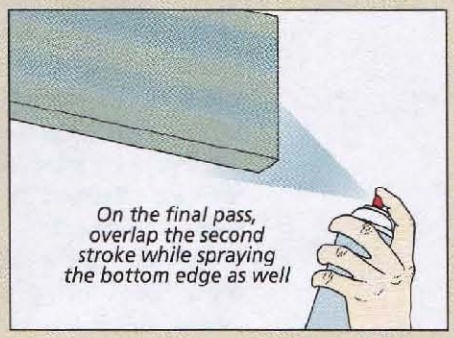
DRAWBACKS. On the downside, aerosols are quite expensive compared to a brush-on finish. This is due to the low yield caused by the high percentage of solvent and the cost of aerosol propellant. Second, you're limited to common, clear shades. Fortunately, there's a product that can help out if you need a tinted finish (box below).

For small projects, the convenience is well worth the cost. You'll find you can get a beautiful finish right out of the can. And the best part is, you won't have brushes or a spray gun to clean up. W









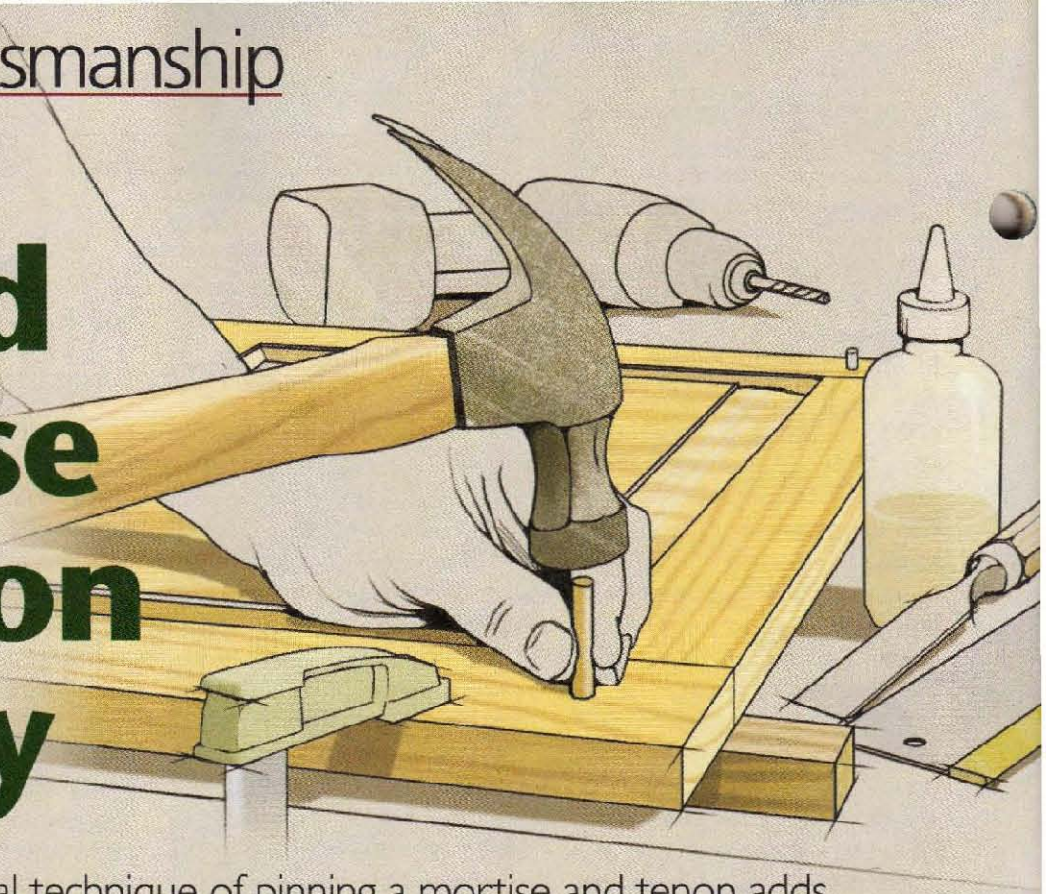
Cool Idea: Preval Sprayer

Although just about all conventional finishes are available in aerosol cans, there are still times when an off-the-shelf finish doesn't meet your needs. This is especially true if you want to add a tint to your finish. That's where the *Preval* sprayer can be a real problem solver.

As you can see in the photos, the *Preval* sprayer is simply a can of spray propellant that attaches to a glass container. You can mix your own batch of any custom finish and get high-quality results. I found that thinning the finish by about 50% worked best and resulted in a nice, even coat.

And the best thing is, the cost of the system won't break the bank. The initial kit includes the glass reservoir and a can of propellant for around $7. Refill cans of propellant are less than $5. Refer to Sources on page 51 for information on where you can order the *Preval* sprayer.

Pinned Mortise & Tenon Joinery



The traditional technique of pinning a mortise and tenon adds both strength and a look of fine craftsmanship to your work.

Mortise and tenon joinery was used long before woodworkers had access to reliable glues. Instead, they had to rely on different methods of locking a tenon tightly into its mortise. One of the most common ways to fix a mortise and tenon joint was to use a wood pin.

The technique is simple in concept. The drawing below illustrates how it works. First, you drill a hole through the assembled joint. Then, a round wood pin is installed through both faces of the mortised piece and the tenon, locking the joint firmly together.

WHY TODAY? Although today it's easy to simply assemble a mortise and tenon with glue, a pinned joint can be just as strong, and may even offer a couple of advantages. For example, a wide tenon assembled with only pins allows wood movement in the joint and may hold up better in the long term.

But aside from any structural benefits, I like to pin the tenons in some projects simply for the sake of appearance. The visible ends of the pins add an interesting detail to an otherwise flat, plain surface. And they leave no doubt as to what type of joinery is holding the assembly together.

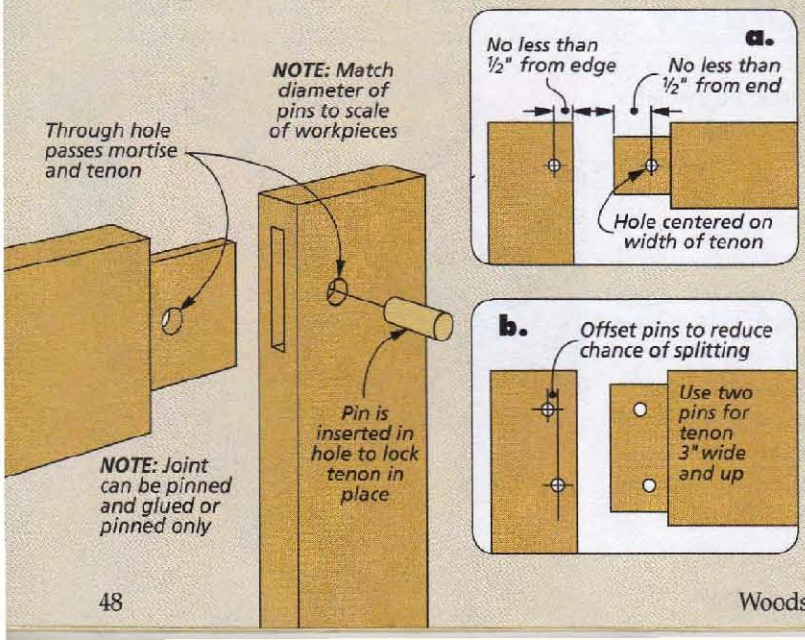
Pinning a mortise and tenon joint is pretty straightforward. But as with every woodworking technique, a bit of know-how and a few tips can make the job easier and more successful. A step-by-step look at the process will give you a good, basic understanding.

STARTING POINT. To begin, the mortise and the tenon are made as usual. All the extra steps come at the end when you assemble the joint. If the joint is going to be glued, I do this first and then pin the joint once the glue has dried.

THE LAYOUT. The first step is to decide which diameter pin to use. Matching the size of the pin to the strength requirements of the joint is important if the joint is not glued. But if the joint is glued as well as pinned, proportion is usually my top consideration.

You want to keep the diameter of the pins in scale to the workpieces. For small to moderate size doors with light, narrow frames, ¼"- or 5/16"-dia. pins look good. For a large door or a table frame, a ⅜"-dia. pin is more appropriate. In heavy, load bearing construction, such as a workbench, pins up to ¾" in diameter may be used.

LOCATING THE PINS. The same two considerations — strength and



appearance — apply when deciding where to locate the pins on the outside face of the mortised piece. The drawings on the opposite page illustrate some general guidelines.

The goal is to lock the tenon into the mortise. To do this, the pin has to have sufficient "bite." This means it shouldn't pass through the tenon too close to the end or either edge. Whenever possible, I center the pin across the width of the tenon and keep it at least ½" from the end.

Likewise, the pin shouldn't be positioned too near the edge of the mortised piece. This increases the chances of the mortised piece splitting under stress. A good rule of thumb is to position it no closer than ½" from the joint line.

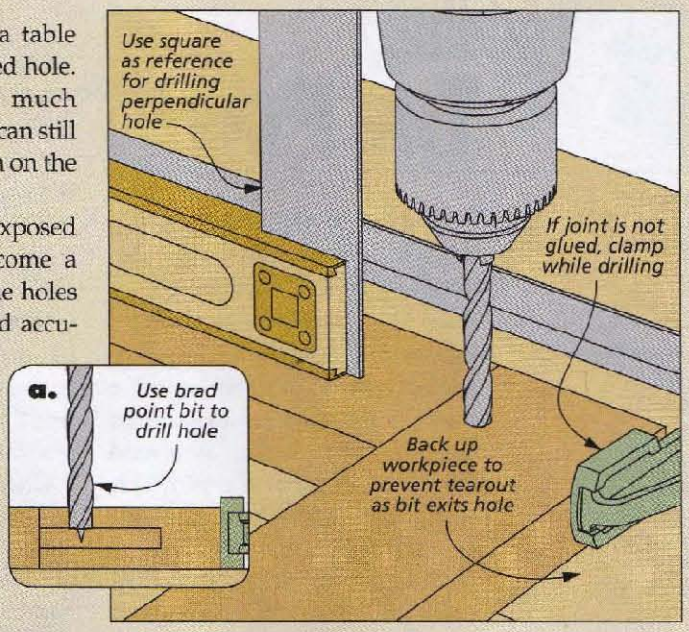
When a tenon is about 3" or more in width, I generally install two pins through the joint. In this case, you may want to stagger or offset the pins from one another, as in detail 'b' on the opposite page. This reduces the chance of the mortised piece splitting along the line of the pins and also creates a more interesting appearance.

STOPPED OR THROUGH HOLES. Once the locations for the pins are laid out, drilling the holes is the next task. The holes can be either stopped or through depending on the project.

When assembling a frame, for example a door, I prefer to use a through hole. It's simply easier to drill the hole and install the pin.

The rail-to-leg joint of a table frame is pinned in a stopped hole. Since the leg is usually much thicker than the apron, you can still get plenty of bite for the pin on the inside face of the mortise.

DRILLING THE HOLES. The exposed ends of the pins will become a focal point, so you want the holes for the pins to be clean and accurately sized. A hand-held drill with a brad point installed is the best tool for this job. And if the joint hasn't been glued up, you'll have to clamp it before drilling the holes, as shown in the drawing at right.



You can try to drill a perpendicular hole simply by eye. But I like to use an upright square for reference. And when drilling a through hole, you always want to use solid backup to prevent tearout as the bit exits the workpiece.

THE PINS. Once the holes are completed, you need pins to fill them. Here, the key is a good fit to the holes — not too tight or too loose.

The pins can be the same type of wood as the frame or a contrasting type. The end grain of the pin will always provide some degree of contrast with the surrounding wood, so I generally use pins from the same wood type.

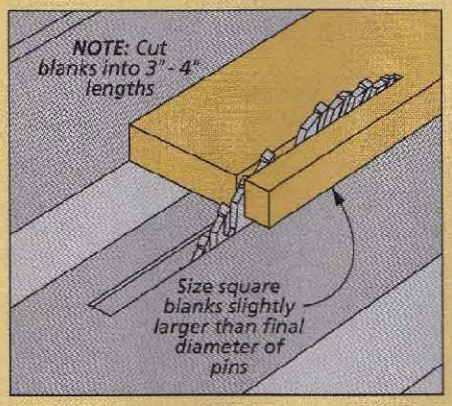
If a dowel rod of the right size and wood is handy, it's easy to cut pieces to length for the pins. A good alternative is to make the pins using a shop-made draw plate, as shown in the box below. This allows you to custom size the pins for a perfect fit and make them out of any type of wood you have available.

The length of the pins should be at least ½" more than the thickness of the assembly. You want plenty of extra length to work with when installing and trimming the pins.

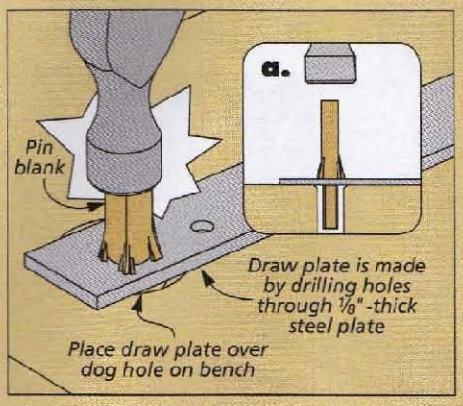
Finally, before setting the pin, the leading end should be chamfered. This allows you to get it started in the hole easier and it will pass through with less resistance. You can do this quickly with a sanding block, a file, or even a block plane.

You can use a draw plate to turn a square blank into a round peg.

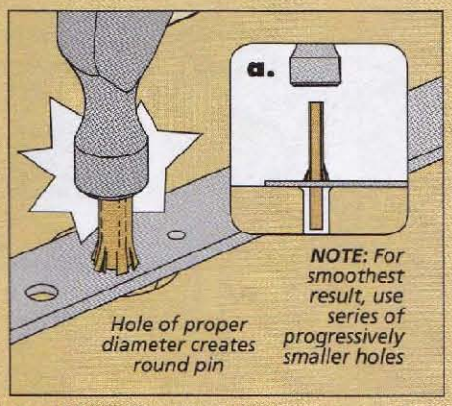
How-To: Make Snug-Fitting Pins



Pin Blank. *Start by ripping a length of square pin stock that's sized slightly larger than the diameter of the pins you need.*



The Corners. *Choose an initial hole in the draw plate that will knock off the corners and then drive a short blank through it.*



Final Size. *The final pass is through a hole matching the diameter of the pins. The blank will be a little rough, but round.*

adding THE PINS

With the holes drilled and the pins made, you're ready to insert them. If the pins are a tight fit, gluing them in place isn't a must, but it's a good idea. The glue fills any gaps and ensures a clean, crisp look once the pin is trimmed. I put glue at the top of the hole, as well as around the leading end of the pin. This way, as the pin is driven home, glue is forced in both directions.

The assembly should be solidly supported above the benchtop, as shown in the left drawing below. You'll need clearance for the pin as it passes through the back side.

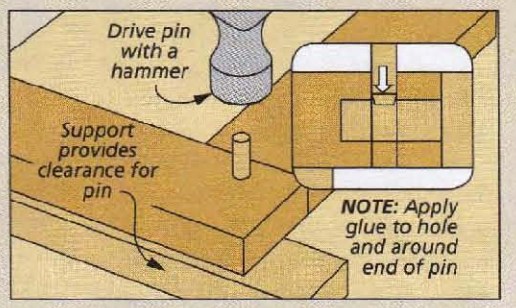
Once you start the pin into the hole, pound it clear through as quickly as possible. You don't want to give the pin a chance to lock up halfway through the hole.

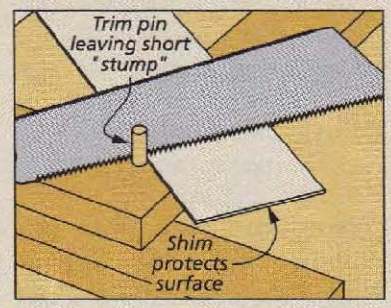
TRIMMING THE PINS. Now all that's left is to trim the pin flush to the surfaces. This is the part of the process that will show, so the key here is to take extra care.

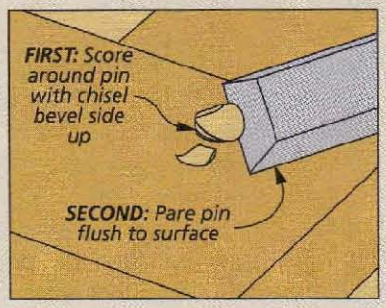
Once the glue is dry, I start by cutting off the pin slightly above the surface with a hand saw. Placing a thin shim between the surface and the saw is a smart precaution against scratches. And saw gently so the pin doesn't break off before it's cut completely through.

Finally, use a sharp chisel to pare the remaining "stump" flush with the surface. Holding the chisel bevel up and resting flat on the surface, score around the entire pin. Then use light paring cuts from all sides to remove the waste. Take care to avoid marring the surface with the corners of the chisel.

After a little finish sanding, you're done. You'll have a joint guaranteed to never fail but always draw attention. And if you want to go the extra mile on your joinery, check out the box below. W

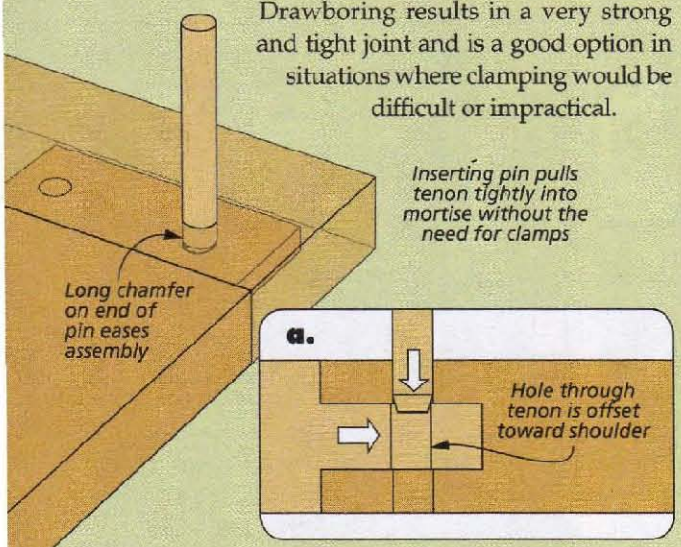


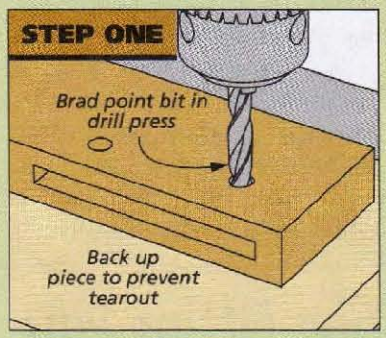




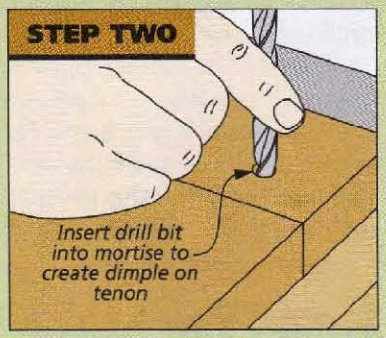
How-To: Drawbore

Drawboring is a variation on a pinned mortise and tenon in which the pin is used to pull or "draw" the joint together without the need for clamps. The way this works is shown in the drawings below and at right. The hole through the tenon is drilled separately and is slightly offset toward the shoulder. When the pin is driven through the joint, this offset causes the tenon to be pulled snugly into the mortise. Drawboring results in a very strong and tight joint and is a good option in situations where clamping would be difficult or impractical.

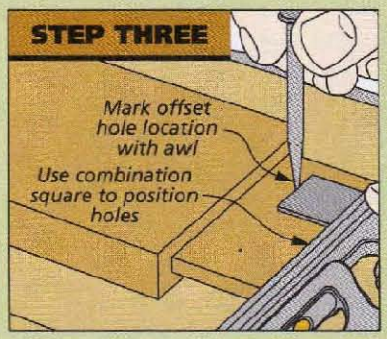




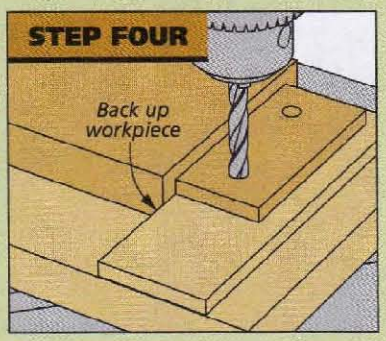
Mortise Holes. *The pin holes through the mortise are laid out and then drilled at the drill press.*



Mark Tenon Holes. *Next, assemble the joint and use the drill bit to transfer the hole locations to the tenon.*

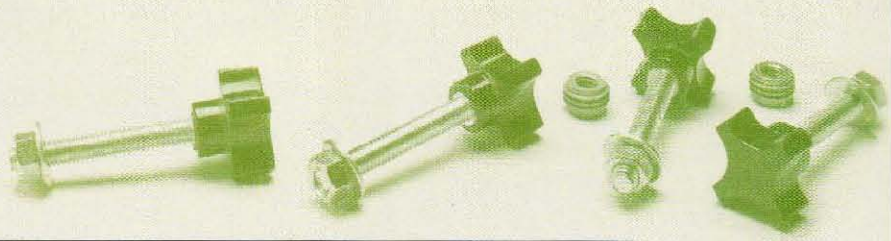


Offset Holes. *With a square and an awl, mark the tenon for holes that are offset 1/32" toward the shoulder.*



Drill Tenon Holes. *Now use the offset marks to drill the holes through the tenon at the drill press.*

Sources



ROTARY TOOL ROUTER BASES

Adding a router base is a great way to get more out of a rotary tool. The *Dremel* plunge router base can be found at most hardware stores and home centers that carry *Dremel* products, or from the sources listed in the margin.

The *Precision Router Base* (5260) is available only through *Stewart-MacDonald*. They also carry router bits for rotary tools.

FLUTING JIGS

Whether you rout flutes on a router table or with a handheld router, the fluting jigs shown on page 8 will make the task easier.

The *Automatic Flute Spacing Jig* is available from the manufacturer, *DRL Group, LLC*. The *Rockler* fluting jig (28636) can be purchased directly from *Rockler*.

CANDLE STANDS

The only item you'll have to purchase for the candle stands on page 16 (aside from the wood) are the candle cups. You can find these at most craft stores.

GIFT BOXES

Like the candle stands, the gift boxes on page 22 also don't require much in the way of hardware. Aside from a few woodscrews, all you'll need is some adhesive-backed felt to line the boxes. This can be purchased at most craft or fabric stores.

BOOKCASE

Most of the hardware for the bookcase on page 30 came from *Rockler*. This includes the 36" shelf standards (34025), 48" shelf standards (34033), shelf supports (33852), and levelers (81696). The anti-tip kit used to anchor the bookcase came from *Hangman Products* (TK-400). The shoulder bolts (00N14.70) and bolt caps (00N20.17) are from *Lee Valley*.

To make the plinth blocks and the crown molding, we used a couple of *Freud* router bits. The plinth blocks were routed with bit 99-015. And the crown molding was made with bit 99-402.

Another option is to use purchased moldings for the bookcase. You can obtain plinth blocks and crown molding from *Jarrett's Woodworking*.

The bookcase was stained with *Varathane* stain (American Walnut) and finished with lacquer.

HAND SANDING

The sanding blocks and adhesive-backed sandpaper shown in the article on page 42 really go a long way toward making hand sanding easier. We purchased these items from the *Woodsmith Store*, but you should be able to find similar products through most woodworking suppliers.

CIRCULAR SAW BLADES

Upgrading the blade on your circular saw is a great way to get better results from this power tool. *Oldham* blades are available at many hardware stores and home centers. *Forrest* brand saw blades can be ordered directly from the manufacturer.

SPRAY CAN FINISHING

Spray can finishes and aerosol spray can handles like those shown on page 46 are commonly available wherever finishing products are sold. The *Preval* spray gun is available through *Rockler* (30998). Or you can contact the manufacturer for a supplier near you. W

Online Customer Service

Click on *Magazine Customer Service* at **www.woodsmith.com**

- Access your account status
- Change your mailing or email address
- Pay your bill
- Renew your subscription
- Tell us if you've missed an issue
- Find out if your payment has been received

MAIL ORDER SOURCES

Project supplies may be ordered from the following companies:

Woodsmith Store
800-444-7527
Adhesive-Backed Sandpaper, Circular Saw Blades, Freud Router Bits, Levelers, Sanding Blocks, Shelf Standards, Shelf Supports

Amazon
amazon.com
Anti-Tip Kit, Dremel Plunge Router Base, Freud Router Bits

DRL Group, LLC
513-451-1599
drlgroupllc.com
Automatic Flute Spacing Jig

Forrest Manufacturing Co.
800-733-7111
forrestblades.com
Circular Saw Blades

Hangman Products
818-610-0485
hangmanstore.com
Anti-Tip Kit

Jarrett's Woodworking
620-218-2084
jarrettswoodworking.com
Crown Molding, Plinth Blocks

Lee Valley
800-871-8158
leevalley.com
Bolt Caps, Shoulder Bolts

Micro-Mark
800-225-1066
micromark.com
Dremel Plunge Router Base

Preval Spray Gun
prevalspraygun.com
Preval Spray Gun

Rockler
800-279-4441
rockler.com
Fluting Jig, Levelers, Preval Spray Gun, Sanding Blocks, Shelf Standards, Shelf Supports

Stewart-MacDonald
800-848-2273
stewmac.com
Precision Router Base, Rotary Tool Router Bits

Woodsmith®

8-VOLUME LIBRARY SET

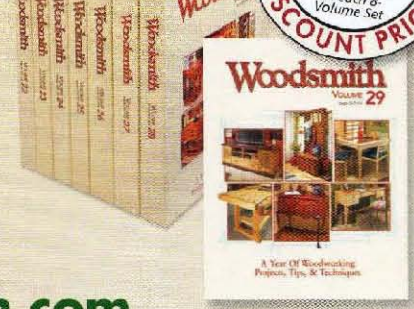
Get all 8 hardbound volumes of ***Woodsmith*** (Volumes 22 through 29). Each volume includes a year of issues, plus a table of contents and a handy index.

Regular Price ..... ~~$239.60~~
Subscriber Discount Price ..... $159.95 ***SAVE OVER $75***

FREE SHIPPING on your entire order!

Individual volumes also available.
(Offer expires 11/30/09)

VALUED SUBSCRIBER DISCOUNT PRICE
SAVE OVER $75 on each 8-Volume Set



Go to Woodsmith.com
or Call 1-800-444-7527 Today to Order Yours!

looking inside

Final Details

Exotic hardwoods and fine craftsmanship come together in this elegant project. Featuring splined miter joints, gracefully shaped handles, and fitted lids, either of these boxes will make a perfect gift. All the details you need to build both boxes are shown in the article on page 20.